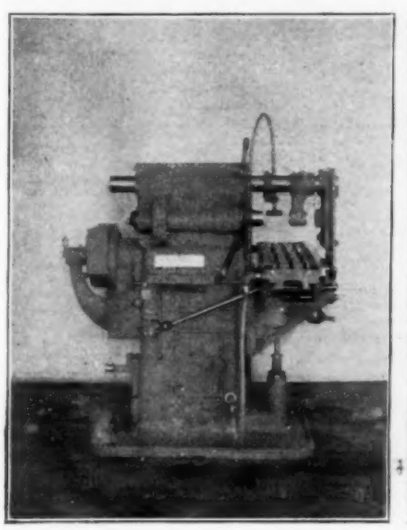
March 25, 1920 American Machinist Vol. 52, No. 13

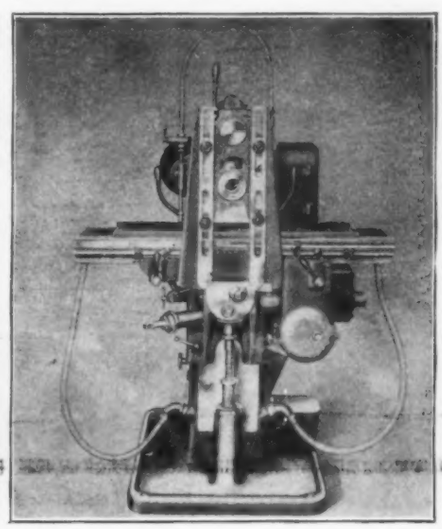
THE student of modern production methods will find a worthwhile study in machine design in the No. 21 automatic milling machine that has taken its place in the line of machine tools manufactured by the Brown & Sharpe Manufacturing Co., Providence, R. I.

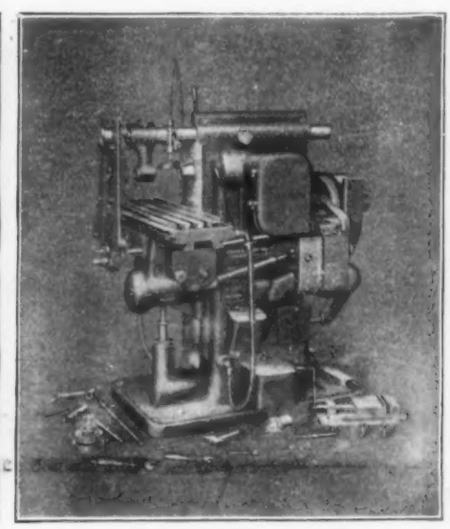
The milling machine described in this article was designed for the production of duplicate parts on a quantity basis and is essentially a manufacturing machine. It is the latest development of a pioneer manufacturing company that had its beginning in 1833.

The sturdy appearance of this latest model shows that the company's established policy relative to design and construction has been closely followed as the machine has structural characteristics common to the other models of column and knee type machines of the same make. The distinction of the new design lies in the application of the automatic control of the spindle and table and in other important features and refinements that are mentioned in this article. The machine is double acting and continuous in operation as will appear from Fig. 1 where two fixtures holding the work are shown in offset position, one at each end of the table. Two sets of cutters with teeth opposed are employed, one set for each fixture and with the dogs set correctly, the machining operation is entirely automatic as the work of the operator is merely that of loading and unloading the fixtures.

The various automatic operations of the spindle and table are obtained through the medium of adjustable dogs located at the front side of the table. These cause slow, variable feed for cutting, and fast, constant travel for the reverse. They are also used, when necessary, to stop the spindle during the reverse movement of the table.







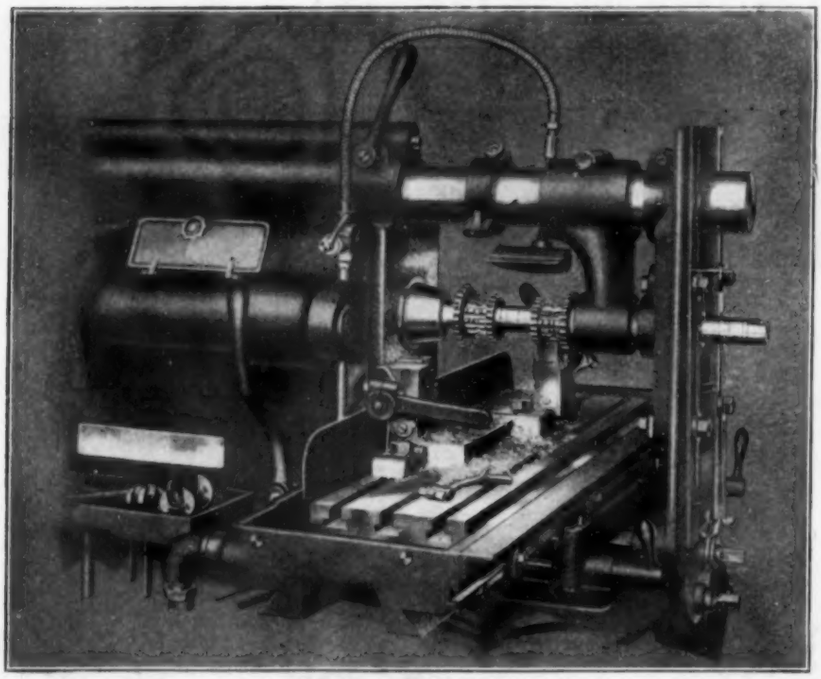


FIG. 1. TYPICAL ARRANGEMENT FOR AUTOMATIC OPERATION

From the illustration it may be seen that one set of cutters is used to mill the piece in one fixture and that the other set of cutters, with teeth facing in the opposite direction, is used to mill the piece in the opposite fixture. While the cutters engage the work in one fixture the operator changes the work in the other fixture. When moving to the reverse position, the table travels at a constant rate of 210 in. per minute. As the work approaches the cutters, the feed is automatically reduced to proper cutting speed and the spindle starts rotating in the reverse direction suitable for the reversed cutters. This cycle of operations is repeated automatically while the machine is working. However, owing to the flexibility of control many variations are possible. For instance, Fig. 2 illustrates how the machine operates with one set of cutters in connection with index heads. Obviously, in this case it would be unnecessary to stop the spindle during the reverse stroke of the table, but as a safety measure for the operator, the table is stopped upon the completion of the cut, protecting the operator when loading the fixture. Similar work, such as milling the tangs on twist drills, could be performed with one set of cutters by using ordinary fixtures. The adaptability of a vertical attachment to the machine is shown in Fig. 3 where a large-size, inserted-blade, face-milling cutter is rotated in the same direction for both cutting operations, although at the finish of each cut the spindle is automatically stopped to prevent marring the work when the table reverses and moves at fast speed to the opposite fixture.

The automatic movement of the table and spindle are controlled by the table dogs, which are quickly and easily adjusted to the various classes of work. The movements may or may not be intermittent in either or both directions and may take place one or more times according to arrangement of the dogs.

Four different style dogs are required to obtain all automatic movements, but for ordinary operations two or three styles are usually sufficient as the setting of the dogs is quickly and easily accomplished and by the applications of the various combinations a surprisingly large number of cycles may be obtained.

Although the automatic control of the spindle and table is by means of the table dogs, the same results may be attained by hand, employing the two controlling levers located on the front of the table saddle.

Occasionally the loading time of a piece exceeds the cutting time and the table is set to stop for the safety of the operator. Under these circumstances the machine is semi-automatic in operation, and the control levers are employed in place of the dogs, the left-hand lever starting the table which has been automatically stopped for the safety of the operator.

The manipulation of these controlling levers is extremely simple and the ease and rapidity with which they may be operated, is in some cases, faster than when it is fully automatically operated.

By means of the hand control levers the machine may be operated as a plain milling machine, accomplishing within its capacity the same results as the ordinary plain milling machine.

Variation of the spindle speed is obtained through change gears giving sixteen changes in geometrical progression from 28 to 695 r.p.m. in either direction. Although these gears, shown in Fig. 4, are totally in-

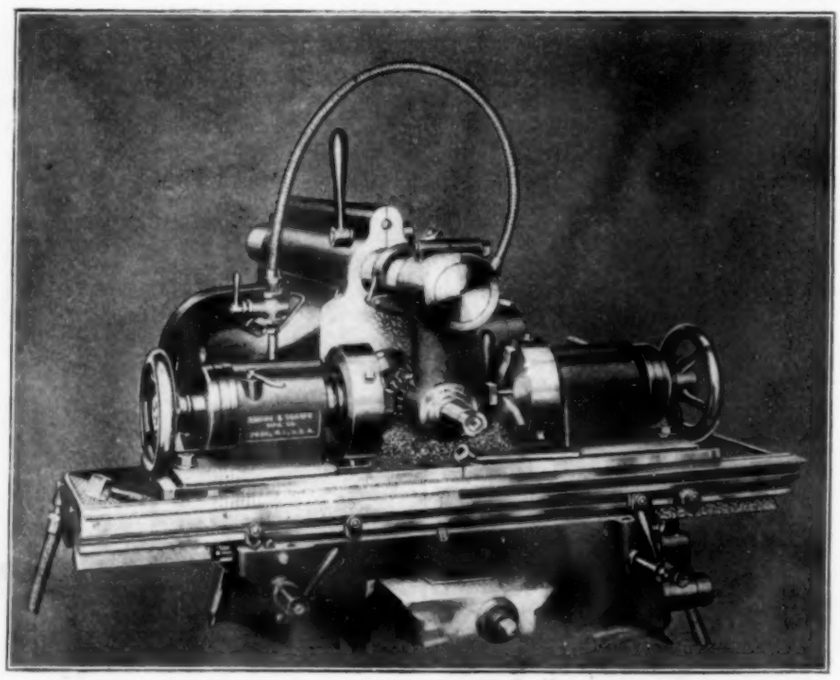


FIG. 2. USING INDEX HEADS WITH AUTOMATIC OPERATION

closed in a heavy cast-iron box, a full-size hinged cover provides ready accessibility. Upon the inside of this cover is cast a table of the spindle speeds with the proper change gears for each.

The table feeds are positive and are entirely independent of the spindle speeds. Twelve changes in geometrical progression are possible by means of change gears. The range is 1.37 to 18.38 in. per minute. This provides a range of 0.002 to 0.026 in. per revolution of the spindle for small mills and 0.026 to 0.656 in. per revolution of the spindle for large mills. The change gears for the feeds are inclosed in a case similar to that for the spindle speeds. A hole in the hinged cover permits a hand crank to be used on squared shaft thus providing means for a slow hand feed to use when setting up.

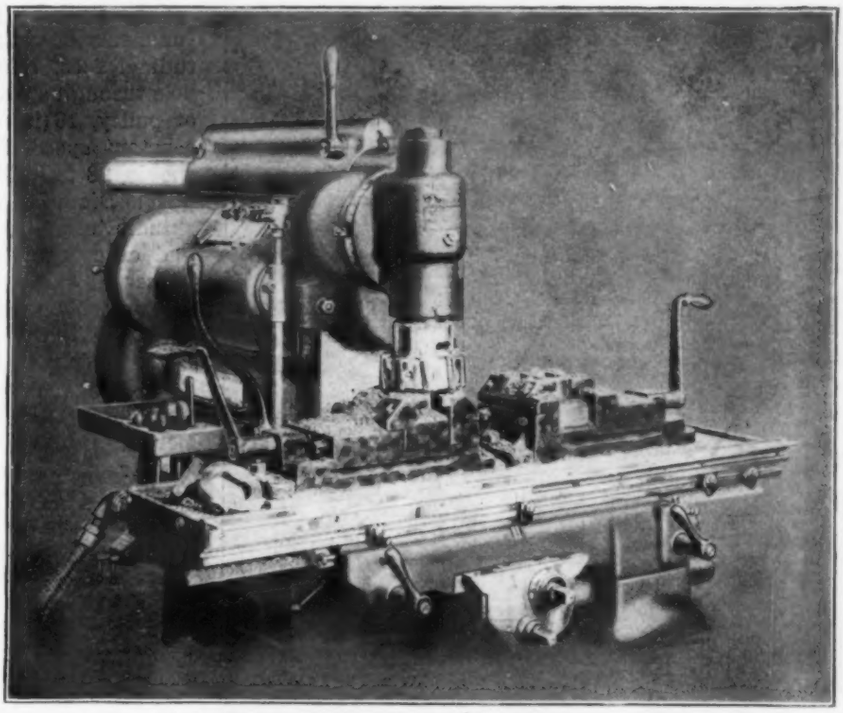


FIG. 3. CONTINUOUS MILLING WITH VERTICAL ATTACHMENT

The reverse gearing and cams that are actuated by the table dogs are assembled as a unit in an oil-tight case as shown in Fig. 5. This unit of mechanism operates the stop and reverse movements of the table and spindle. The gearing is automatically lubricated and is protected by a safety friction coupling set to slip at a predetermined load, thus guarding against possible damage.

A constant-speed drive makes the machine readily adaptable to the application of a motor and permits of the complete separation of all speeds and feeds of which there is a wide range. The driving pulley is amply guarded and is provided with a friction clutch for the stopping and starting of the machine. The power is controlled by a lever conveniently located at the front side of the machine. On the driving shaft is mounted the spindle reversing clutches, the spindle stop clutch and instantaneous braking arrangement. The spiral-type bevel gearing employed in the spindle reversing mechanism and the back gears are illustrated in Fig. 6.

Feed Gearing

Another unit of mechanism that responds to the action of the table dogs is shown in Fig.. 7. This arrangement of gearing, etc., controls the fast travel and cutting feeds. The clutch and cams at the top of the case are used to cause the feed changes. The hardened spiral gears on the left constitute the drive for the fast feed and the large worm gear in the center acts in a similar capacity for the slow variable feed. The table rack driving pinion may be seen on the extreme left of the case. Ball bearings are provided throughout and all parts are provided with automatic lubrication and contained in an oil-tight case that is located directly below the table.

Taper Nose Spindle

The front end of the spindle is tapered, hardened and ground and has a recess to receive the cutter driver and clutch on arbors and collets. Arbors and collets are provided with clutches and have a threaded hole in the end of the shank, the clutch fitting into the recess in the end of the spindle and the arbor or collet being drawn into place and held securely by the drawing-in bolt which passes through the center of the spindle. The threaded end of the drawing-in bolt enters the end of the

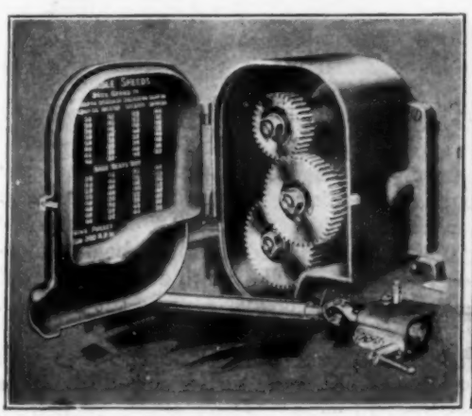


FIG. 4. SPINDLE-SPEED CHANGE GEARS INCLOSED IN HEAVY CAST-IRON BOX

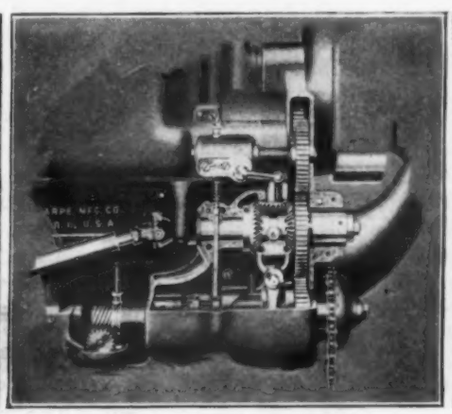


FIG. 5. REVERSE GEARING AND CAMS, CONTROLLING STOP AND REVERSE MOVEMENTS

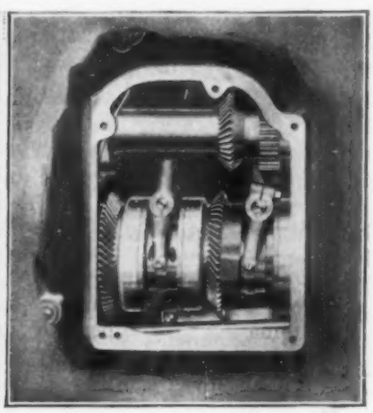


FIG. 6. ARRANGEMENT OF GEARING CONTROLLING FEED CHANGES

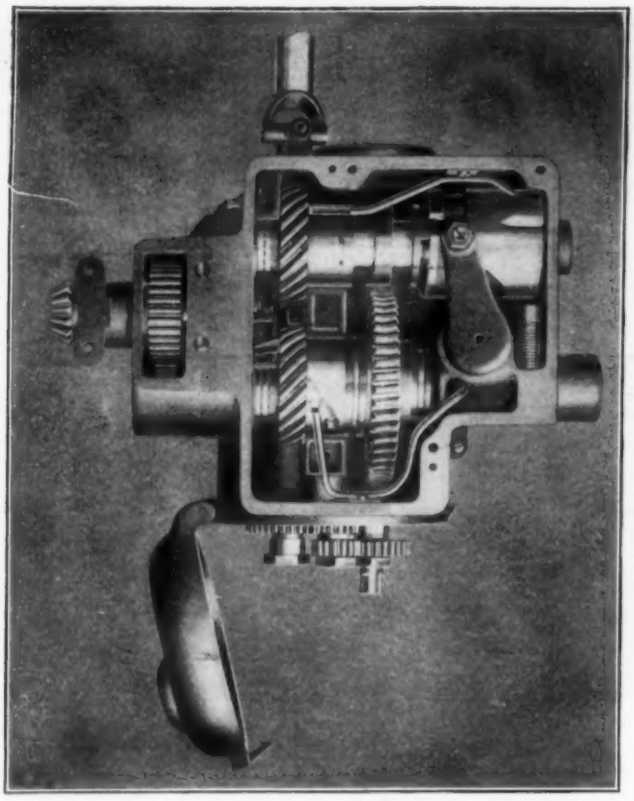


FIG. 7. SPINDLE DRIVE GEARING AND FRICTION CLUTCHES

shank of the arbor or collet and is tightened with a wrench from the back of machine.

Face-milling cutters are drawn directly onto the taper nose of the spindle by a cutter driver and the drawing-in bolt. The cutter driver fits into a slot in the face of the cutter and the recess in the spindle and the shank is threaded on the end to receive the end of the drawing-in bolt which draws the cutter onto the spindle with the aid of a wrench from back of the machine.

The simplicity and fewness of parts is particularly noteworthy. No plates, screws or loose parts are used and when the arbor, collet or cutter is in place it is essentially as firm as though a part of the spindle itself. Because no screws or plates are used the nose of the spindle is smooth and entirely free from projections.

The removal of arbors, collets and face-milling cutters is as readily accomplished as their replacement. This can be best appreciated in the case of face-milling cutters, no such troublesome, time-wasting condition as "freezing" of cutter to spindle, being possible.

A good feature of the machine is the automatic lubrication of all rotating parts within the frame. Filtered oil is pumped to a reservoir cast in the top of the frame and by means of pipes and a gravity system, oil is constantly distributed to the various bearings. For heavy manufacturing, an abundant supply of cutter lubricant is pumped from a tank of large capacity located within the base. The wearing surfaces of the table and all bearings are of generous proportions and means of compensation for wear is provided where necessary. The column, knee and table are provided with internal bracing and reinforcing ribs. The arbor is amply supported by means of an adjustable overhanging arm, and an arbor yoke furnishes added support for heavy duty-work.

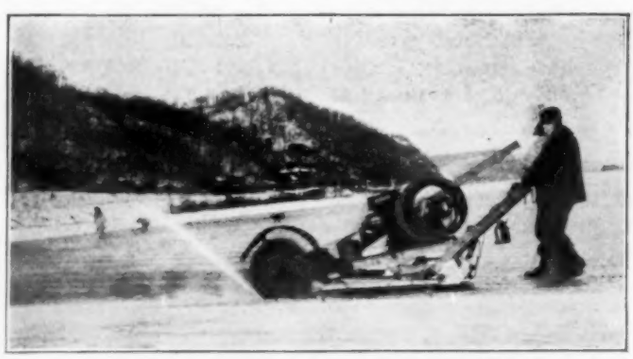
Capacity: Longitudinal feed, 22 in.; transverse adjustment, 6½ in.; vertical adjustment, 14½ in., longitudinal feed, automatic. Spindle: No. 10 taper hole; hole through spindle, $\frac{3}{4}\frac{1}{2}$-in. diameter. Drive: Diameter of pulley, 13 in.; width of belt, 3 in.; 5 hp. required; constant speed, 300 r.p.m.; sixteen changes of spindle speeds, 28 to 695 r.p.m. in either direction. Arbor support: Diameter of hole in bushing, $1\frac{3}{16}$ in.; center of spindle to under side of arm, 5½ in.; greatest distance, end of spindle to center in arbor yoke, without arm braces, 16 in.; greatest distance, end of spindle to arbor bushing, in arm braces, 10½ in.; greatest distance, face of column to arm braces, 16 in. Table: Working surface, 34 x 11 in.; overall dimensions of table, 44 x 11 in.; 3 T-slots, $\frac{5}{8}$ in. wide. Feeds: Positive, independent of spindle speeds. Twelve changes from 1.37 to 18.38 in. per minute; fast travel between cuts, 210 in. per minute. Cutter Lubrication: Tank cast in base; pump furnished inside of frame; capacity of tank, 7 gal. Vise (flanged) Capacity: 6¼ in. wide, $1\frac{9}{16}$ in. deep; opens 3⅝ in. Floor Space: At right angles to spindle, 67 in.; parallel to spindle, 59½ in. Weights: Net, about 3,350 lb.; ready for shipment, about 3,775 lb.; dimensions for shipment, 62 x 42 x 66 inches.

An Improvised Ice-Cutting Machine

BY F. L. CLARK

The illustration shows an ice-cutting machine which was rigged up for an Iowa small-town ice dealer and which performed the work much more economically than it could have been done with a team, the time-honored way of harvesting ice in towns and villages.

There are ice machines of several kinds on the market, but the small-town ice dealer and the farmers who put up ice in comparatively small quantities can not afford them. A machine like this one, however, can be put together at small cost at ice-harvesting time and taken apart at the end of operations, leaving the components available for other purposes during the rest of the year.



THE ICE-CUTTING MACHINE AT WORK

A five-horsepower gas engine was used and the saw from a wood-cutting machine. A sled about 4 ft. wide and 6 ft. long was made of boards and 2 x 4s, a marker attachment extended from one side and two beams fastened obliquely at the back. The engine was mounted on the sled and belted to the saw which was set in front to the right.

With the wood pieces at the back the two men who operated the machine could pull it along with little effort. The machine all assembled weighs but 1,000 lb. and can be used on ice too thin to stand the weight of a team.

Welding Boiler Tubes by the Electric Resistance Process

By P. T. VAN BIBBER
Sales Engineer, Thomson Electric Welding Company

About 1912 the resistance, or Thomson, process of electric welding was first tried out in a locomotive shop for the purpose of replacing the oil-furnace welding equipment in safe-ending boiler tubes up to 2½ in. in diameter. At the present time, in shops in different parts of the country where electric welding machines have been installed, one will find many enthusiastic "boosters" for this process. It is to these users that we are indebted for the information contained in this article and for the benefit of those who are unfamiliar with this adaptation of resistance welding, an endeavor has been made to cover all the details possible.

IN USING the resistance type of machine for welding safe-ends onto locomotive-boiler flues, the old tube and the new safe-end are gripped securely in heavy copper jaws with the ends to be joined held in alignment. As these ends are pressed together a large volume of current from the secondary winding of the transformer is passed through them. Since the junction of the abutting ends is the point of greatest resistance to the electric current, the greatest heating effect is there and, usually, on a 2½-in. tube it requires only about 15 sec. to secure a perfect running or welding heat. A slight push-up by the pressure device on the welding machine sticks the two parts together solidly enough so that the tube can be removed to the mandrel of a rolling machine, exactly as is done when welding by the oil-furnace method, and the weld is then completed in a few seconds by rolling down the joint.

Since it is always necessary to scarf the ends of a tube and new safe-end before welding by the oil-furnace method, the first question that the practical boiler-shop man will ask is, How much preparation is needed for electric resistance welding? The first step in any method is to clear the tube from heavy scale, if in use under bad water conditions, by rolling in a large tumbling barrel. After this, the tubes are cut to the desired length to remove the old end that is to be replaced by the new section.

In some shops it is the practice to never allow more than one or two welds in a tube, which means that after removing the second time, the tube must be used in a shorter boiler than before. This procedure is carried out until the tube can only be used for small switching locomotives—if it lasts that long—after which it is scrapped. By this method, only one length of tube is bought new, which is that required for the longest boilers.

In other shops the writer found tubes with many welds, showing that the safe-ending was continued in order to maintain the same length each time until the tube was worn out, when it was replaced by a new one of the required length. This latter method necessitates buying several lengths new but in localities where the water is not very hard on tubes, it prevents a tube from going to the scrap pile as long as there is any good in it. After cutting off the old tubes, as shown in Fig. 1, which represents a common type of machine for this purpose, the tubes are next scarfed, or cut off square, according to which method of welding is to be employed.

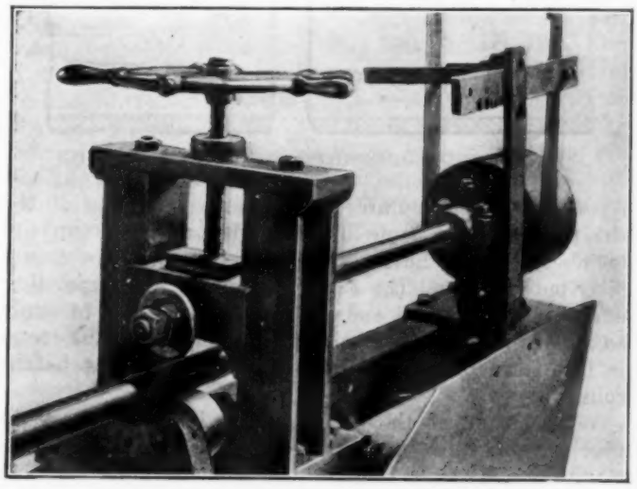


FIG. 1. MACHINE FOR CUTTING OFF FLUES

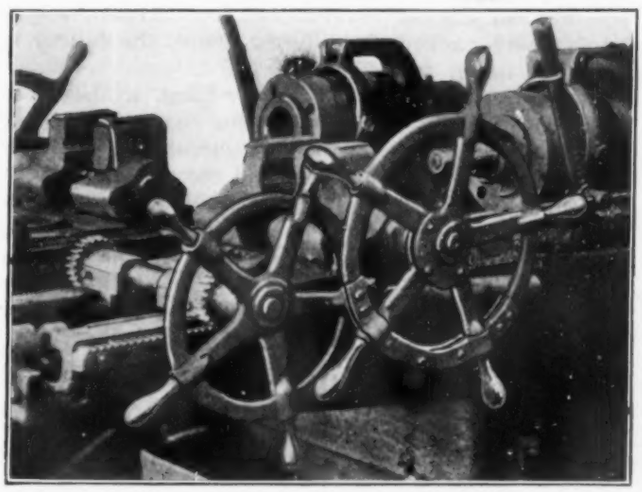


FIG. 3. BOLT THREADING MACHINE MADE INTO A SCARFING MACHINE

If a scarf weld is to be used, the old tube is generally beveled on the outside at an angle of from 45 to 60 deg., according to the length of scarf desired, about as shown in Fig. 2. The bevel is wholly a matter of personal opinion for just as good welds can be made with a 30-deg. scarf as when one of 60 deg. is used.

One type of machine used for scarfing is shown in Fig. 3. This has been rigged up from an old bolt-threading machine. The jaws shown at the left are for gripping the old tube which is then fed into a revolving chuck by means of the handwheel. This chuck

contains the necessary cutters for forming the desired bevel on the outside of the tube end. The jaws on the right-hand side of the same machine grip the new short ends as they are fed onto a revolving tapered reamer, which cuts a scarf from the inside. In some shops, the scarfing is done on an old lathe with special fixtures, but the remodeled bolt-threading machine seems to offer the most efficient proposition for, with this type of machine, it is possible for one man to scarf over 60 tubes and ends per hour.

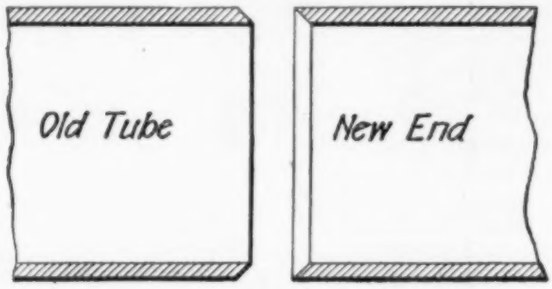


FIG. 2. ENDS PREPARED FOR SCARF-WELD

If a straight butt-weld is to be made instead of scarfing the ends to be joined, they are cut off squarely, as shown in Fig. 4. This is done in an old pipe-threading machine, or a lathe, so that when placed in the welding machine, the abutting ends will be in contact practically all the way around their circumference. Although this last method of preparing work may sound shorter than scarfing, nevertheless, from actual observation of both methods in different shops, the former is faster by nearly two to one.

After preparing the ends for welding, if the tubes have not already been tumbled to remove all scale, which usually leaves the outside surface quite bright and clean, it is necessary to grind the surface of both old tube and new ends back to a distance of about 8 in. in order to secure a good electrical contact between the tube metal and the copper jaws of the welding machine.

There are three distinct methods of welding boiler tubes, which are called butt-, scarf- and flash-welding,

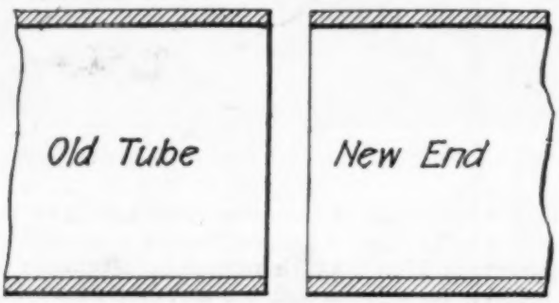


FIG. 4. ENDS PREPARED FOR A STRAIGHT BUTT-WELD

the latter producing the same effect as a scarfed joint when completed. In the straight butt-weld, the ends to be joined are first brought firmly together by means of the pressure device on the welding machine, and the current is then turned on. There is always some point around the circumference of the tube which starts to heat first, due to the impossibility of making the two ends to abut with the same pressure at all points of their contacting surfaces. However, the heat will gradually become uniform all around the circumference before the welding temperature is reached. The current is maintained through the tubes until the joint reaches a good running heat, as evidenced by a "greasy" appearance of the surface, when the pressure is applied sufficiently to push up the hot metal about $\frac{1}{4}$ in. which partly completes the weld. The jaws are then released and the tube is immediately thrust onto the mandrel of the rolling apparatus, which is described further on, and the bulge at the joint, caused by the pushing up of the hot metal, is rolled down until the joint is of the same diameter as the original tube.

This rolling-down operation, in addition to reducing this bulge of the tube, also forces a complete union of the plastic metal of the two pieces, thereby completing the weld. From this it may be seen that in welding boiler tubes, the welding machine is only used for a heating device to supplant the oil furnace, requiring only sufficient pressure to stick the ends together to hold it while removing work to the rolling machine where the welding is finished.

In the scarf weld, the beveled end of the old tube is pushed into the chamfered end of the new piece and the current then turned on the same as in making the butt-weld just described. Due to the "feather" edge of the short new piece, it is often necessary to apply the current intermittently until the joint is well heated

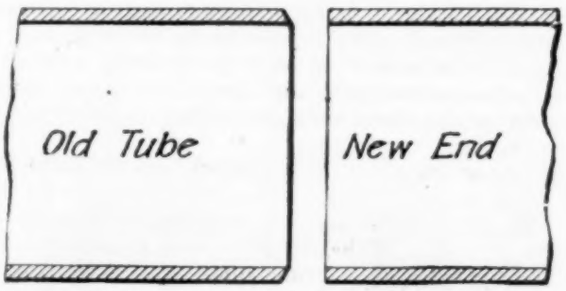


FIG. 5. ENDS PREPARED FOR A FLASH-WELD

all around the circumference; otherwise points of the sharp edge, which come in contact first with the opposite member, will be burned off before the heat is evenly distributed around the tube. Owing to the expanding effect of the scarfed ends, it is not necessary to apply so much pressure as with the butt-weld when the metal is plastic in order to stick the pieces together before rolling down.

With either of the above welds, it is necessary to give the old tube more projection beyond the copper clamping jaws than is given the new short piece. This is because the wall thickness of the old tube has been slightly reduced by wearing away in service and if the two parts were given the same projection, the end of old tube would heat much more rapidly than that of the new piece since its resistance to the electric current would be greater, owing to the reduced sectional area. It is always necessary for the heat to form uniformly in each of the abutting ends or one will burn away before the other reaches the plastic stage.

In making a flash-weld, not so much preparation is required as for the two other methods just described; hence it is a much cheaper job and yet, from all tests made so far, it is the only type of joint which is always 100 per cent perfect when considering the number of defective welds in any lot of tubes. The old tube is cut off the right length in a machine, which has a cutting wheel so beveled as to give an angle of 30 deg. from the vertical on the end of the tube, as shown in Fig. 5. The new ends are bought direct from the tube manufacturers with both ends cut square

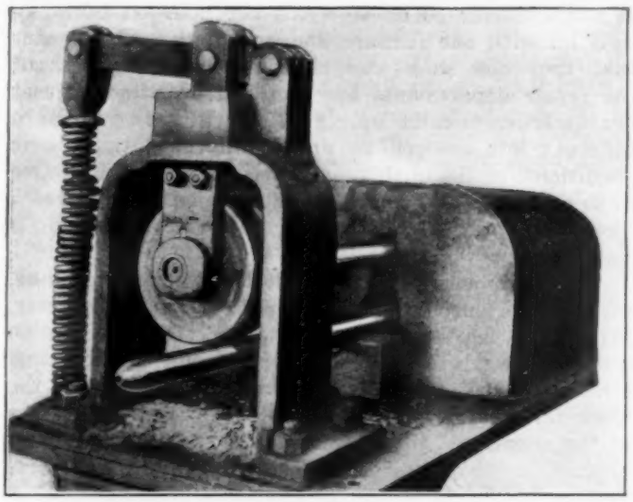


FIG. 6. SIMPLEST FORM OF ROLLING MACHINE

and the surface cleaned well so that there is no preparation needed on the new pieces. After cutting off the old tube it is only necessary to grind it on the outside about 8 in. back from the end to insure good electrical contact. The old tube is placed in the clamps with about 4 in. of projection and the new end with about 3 in. The current is turned on first and the pressure is then applied very slowly and steadily to bring the abutting ends into contact. As soon as they meet, a small arc or "flash" is formed which commences to burn away the points of metal coming into contact first. This flashing is continued until the abutting ends are arcing all the way around the circumference and by this time the sharp edge of the old tube, although somewhat burned away itself, has burned its way into the square-cut end of the new piece. A sudden application of more pressure stops the flashing and the joint then quickly attains the running or welding heat as in the butt- or scarf-welding method. The ends are now shoved together and as the current is turned off, the end of the old tube will have forced itself into the end of the new piece sufficiently to form a scarf-weld when rolled down in the rolling machine.

Using a Flux

From statements made by every operator interviewed, the use of flux does not help the welding in any way; yet it is used in each shop because it clears up the surface of the metal when the plastic stage is reached and enables the operator to judge the appearance of the heat more easily. The writer is confident that if a new operator were to be broken in on a welding machine, he would soon be able to correctly judge the right welding heat of the metal by its appearance without any flux, as there are many pipe shops using electric-welding machines for making joints in long coils, where flux was never heard of. Each railroad shop uses a slightly different kind of flux, but generally this material is nothing more than a common yellow clay, streaked with quartz formation, which has been pulverized and thoroughly dried out before using.

There are several methods and machines employed in the various shops for rolling down and completing the weld after heating the joint properly. One of the simplest machines in use is shown in Fig. 6. It consists of a power-driven mandrel slightly smaller than the internal tube diameter, above which is a power-driven roller. This roller is held a short distance above the mandrel by a spring. When the hot tube is thrust onto the mandrel, the upper roller is brought firmly down onto the outside surface of the joint by pressure on a foot treadle located under the table on which the device is mounted. The pressure is maintained until the joint has been rolled down to outer tube size. The main disadvantage of this style of apparatus is that the speeds of the roller and the mandrel must be in the correct ratio so as to not allow any slip on either inner or outer surface of the tube, otherwise the tube will roll unevenly and when finished will have a thicker wall on one side than on the other. However, this is the earliest form of rolling machine used with the electric-welding method and is still giving fairly satisfactory service in two well-known shops today.

Another type, which is more elaborate but more positive, is a three-roller machine, shown in Fig. 7. The mandrel here is stationary and the three idling rollers, being mounted on a power-driven head, continually revolve around it. After inserting the tube, which is also held stationary, pressure is applied by means of a hand lever which closes the three rollers in toward the center of the mandrel and the joint is rolled down by the surface pressure of the three rollers revolving around it. In order to still further insure uniform rolling, the tube is turned slightly on the mandrel three or four times during the rolling operation since the mandrel is slightly smaller than the tube and if the latter were to be held in only one position, a difference in wall thickness on one side might result.

Rolling machines of the types just described are sometimes located in direct alignment with the jaws of the welding machine, so that after obtaining the proper heat, it is only necessary to release the jaws and shove the hot tube directly onto the mandrel. If the three-roller type is being used, the tube is held stationary by locking one jaw of the welding machine. When a new position on the mandrel is desired the jaws are released and the tube allowed to turn slightly with the friction of the revolving rollers.

Another method is to have the rolling machine in back of the welding machine so that when the correct

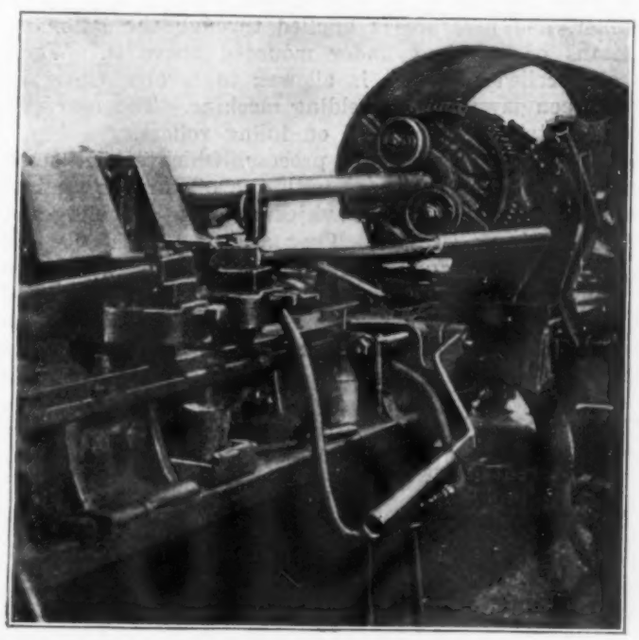


FIG. 7. THE THREE-ROLLER, OR HARTZ TYPE, MACHINE

heat is obtained, the tube is lifted out of the jaws by the operator's assistant who shoves it onto the rolling mandrel, leaving the operator free to get the next tube lined up in the machine for heating. In this last method, the assistant must act quickly so as not

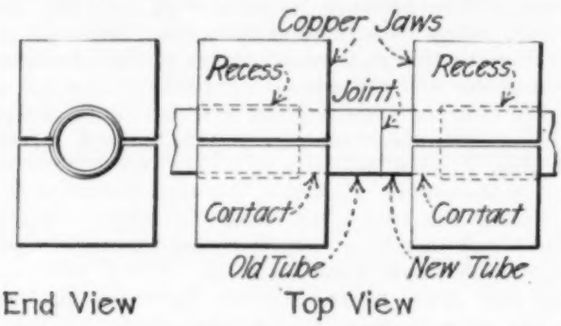


FIG. 9. RECESSED COPPER CLAMPING JAWS

to allow the joint to cool down before the rolling, as he cannot transfer the tube from the welding to the rolling machine as quickly as the operator could shove it forward onto the mandrel as first mentioned.

As to speed in welding, the writer observed that the same production could be obtained in different shops by either method of locating the rolling machine; hence it is purely a matter of space available around the welding machine, and local opinion.

A third way of handling the rolling down is to have the rolling machine built onto the welding machine, as shown in Fig. 8. In this particular apparatus, the mandrel is made long enough to permit welding in to a distance of 10 ft. from the joint, so as to reclaim old short tubes by making a new long one with a joint in the middle. This reclaiming of tubes has proved to be perfectly practical, having been forced in one locomotive shop during the war due to the inability to obtain new tube stock. The mandrel is power driven as well as the upper roller, while the two lower rollers are idlers. After obtaining the welding heat, it is only necessary to move the tube about one foot to bring the joint onto the rollers. A clutch at the rear end is then thrown in to revolve the mandrel and upper roller, and pressure is applied through the latter by means of an air cylinder mounted above it. While being rolled the tube is allowed to revolve freely in the open jaws of the welding machine. The rear end of the tube is supported on idling rollers.

After the rolling-down process, which is the same as has always been used with the oil-furnace method of welding, the tubes are subjected to the annealing and end-swaging processes. They are then usually tested hydrostatically for possible leaks and stacked away ready for assembling in the boiler. The percentage of leaks is less than 5 per cent in any shop, and in one shop they are so sure of their welding that the tubes are not tested until completely assembled in the boiler when the latter is subjected to a hydrostatic test as a complete unit. This particular shop uses the flash-weld method and has never had a defective joint since the welding machine was installed over four years ago.

Merits of Electric and Oil Heating

When asked to compare the electric welding with the oil-furnace method on boiler tubes of any size, one of the oldest users of the former replied that there was "no comparison." Using oil it was never possible to average over 30 or 40 welds per hour on tubes up to 3 in. with one furnace and one gang. This meant that the tube shop was always behind the rest of the repair departments and working overtime a great deal in order to catch up. Fuel oil will vary greatly in different lots as well as under different atmospheric conditions, so the oil furnace itself is a constant source of aggravation and calls for continual adjusting, which means an interruption in production while the fire is regulated.

As to production with an electric-welding machine, the average output on tubes up to 3 in. in diameter, taken from all shops using this process, will run 60 completed welds per hour, requiring one operator and a helper at the machine and a third man to prepare the work for welding. In the days of piecework, in some of the shops, records show that the maximum number of small tubes turned out in any shop, with the same number of men, was 125 per hour or a little better than one tube every 30 sec. and this could be kept up for two hours at a time without greatly tiring the men. This speed was obtained by three different shops, each using a different style and arrangement of rolling-down apparatus, which shows that all of the methods outlined previously in this article are equally fast.

On welding superheater tubes at the reduced section, where the diameter at the point of weld is about 4⅜ in., the production will run about 10 to 20 welds per hour, although better time has been made on piecework. By comparing these figures with the oil-furnace welding production, even under the best of working conditions, nothing further need be said as to the speed of the electric process.

As to cost, there are no figures available later than 1916, which of course would be much lower than at the present day, but by comparing costs of both methods at that time, taking into consideration upkeep, labor, cost of heat either way and cost of time lost by making adjustments or repairs to either apparatus, the electric costs per 1,000 tubes welded, is about one-third that of the oil-furnace method.

The only wear on the welding machine is the surface of the copper dies or jaws which grip the pieces and this is so slight as to only require smoothing off a few times a week. The machine does not cost anything for heating energy except when the weld is being made and it is always ready for action as soon as the operator has placed the work in the jaws. Hence there is no delay in starting up the fire in the morning or after lunch hour nor from the fire balking at any time during the welding. The replacements on welding machines in all the shops visited by the writer could be easily covered by $100 during the last six years.

In recapitulating the three methods of electric welding flues, it is safe to say that the flash-weld, which produces a scarfed joint when finished, takes the lead for simplicity of preparation, speed of actual welding and reliability as to percentage of failures in any lot of tubes.

Next to this comes the straight scarf-weld, which requires machining of the ends before welding but insures a good joint after welding although occasionally a small leak will show up on the first hydrostatic test. As stated before, the percentage of leaks is very low with this type of weld and practically negligible with the flash-weld.

The butt-weld, which was originally employed in all the shops, is now only used in one shop in the whole

country, probably due to the difficulty in making a perfect weld each time as compared to the ease of making a scarf weld. However, this one shop claims very high efficiency with a butt-weld, both as to tensile strength, which will average over 85 per cent of original tube section, and as to tightness of the joint under pressure.

The principal objection offered by most shops against butt-welding is that should the weld prove tight under pressure, but still be a weak joint mechanically, it might break apart in service. This has happened in a few cases, allowing the tube to drop down in the boiler and subjecting the engine crew to the danger of scalding. With a scarf-weld, which generally shows a tensile strength equal to that of the original tube, due to the area of the weld, should the tube not be welded strongly as just cited and a break should occur inside the boiler, the scarf would prevent the tube from pulling away from its end and only a slow leak could result. This sometimes actually happens with oil-furnace welded tubes.

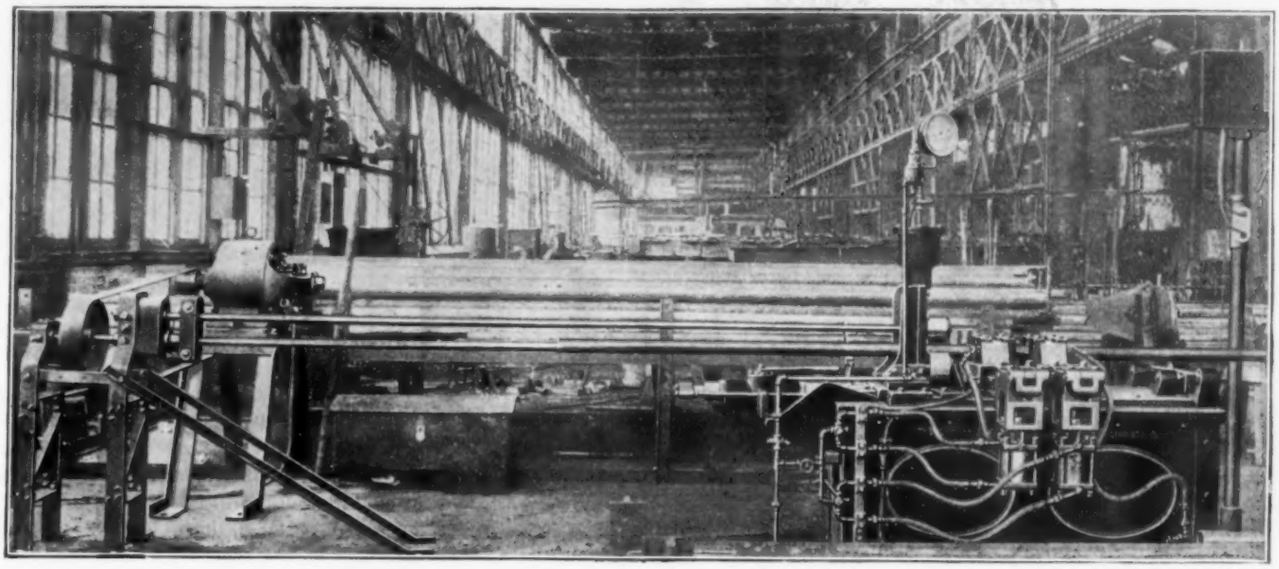


FIG. 8. ELECTRIC WELDING MACHINE WITH BUILT-ON ROLLING DEVICE

The Kind of Machine to Use

As there are different styles and sizes of welding machines being used at the present time on flue-welding, the writer will endeavor to specify special characteristics that should be sought when selecting a machine for this class of work, which is different from any other pipe-welding job. The machine should be constructed to be as efficient electrically as possible; that is, the clamping jaw should be as close to the transformer as is practical in order not to have large inductive losses caused by the large gap due to the long secondary leads widely spaced. The fewer the joints between the secondary loop of the transformer and the copper jaws which grip the tube, the less chance will there be for resistance losses that cut down the heating effect gradually as oxides form in the joints or by dirt collecting from allowing them to become loose. Although the jaws should be long to permit thorough water cooling, it is only necessary to grip the pipe over a length of about 2 in. This length is bored out to exactly fit around the tube as shown in Fig. 9.

The pressure device does not need to be as heavy as would be used on the same welding machine for joining ordinary pipe or solid stock, since the squeezing together of the plastic metal is really done in the rolling machine. For fastest operation the clamping jaws should be operated by air cylinders so that only a slight movement of two valves is necessary to lock or unlock the tube in the jaws.

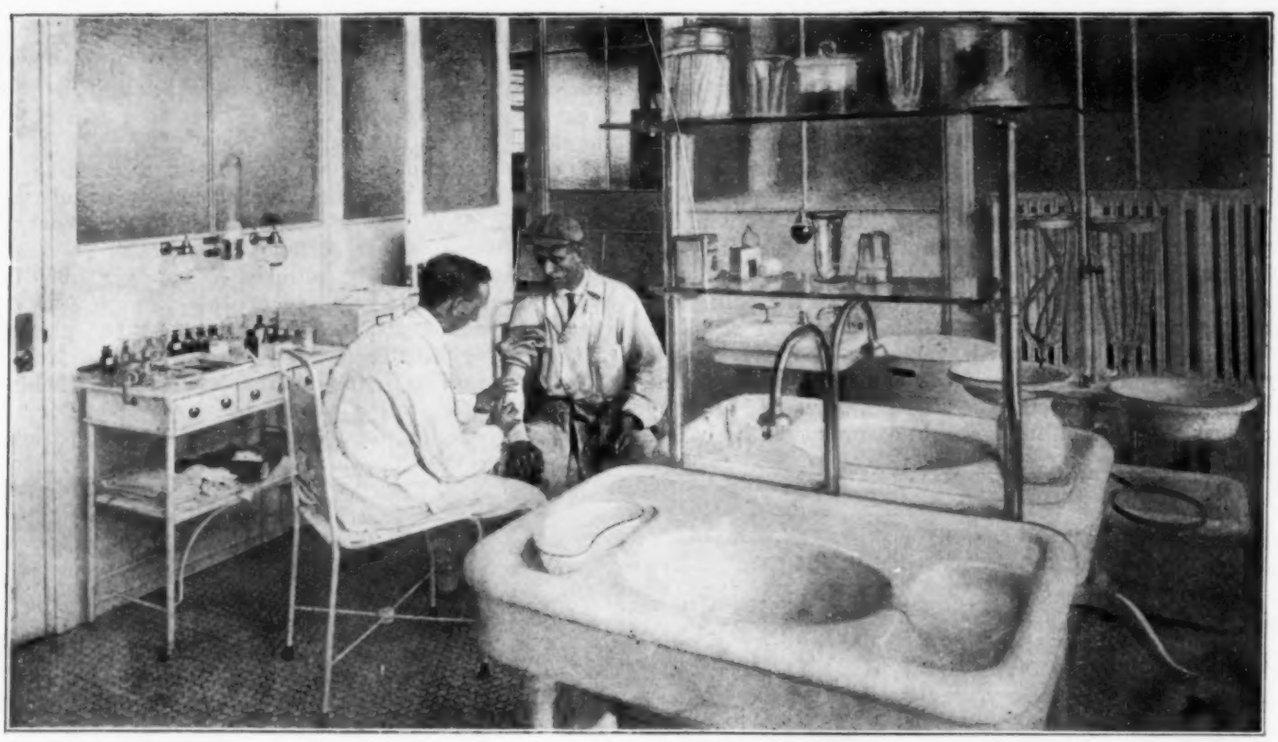
For welding up to 3-in. size tubes, a machine of 30-kw. rating ought to be large enough to stand constant use. Any form of toggle lever or screw-wheel pressure device, which permits the operator to stand close to the work will be suitable, as not over 1,000 lb. effective pressure is required on this size of work to stick the ends together sufficiently hard for placing in the rolling machine.

To handle up to 5½-in. superheater tubes, a machine of about 75-kw. rating should be employed. For its pressure device, an air cylinder or hydraulic apparatus may be used to best advantage so as to secure up to three or four tons' maximum effective pressure.

For ordinary butt- or scarf-welding, a hand-operated oil jack may be used, although trouble has been experienced in the past with this type of pressure device due to sticking of the valves at critical times, often spoiling a weld.

Flash-Welding

For flash-welding, a toggle lever or hand-screw wheel on small machines and an air cylinder or hydraulic pressure device on large machines *must* be used, to effect a slow steady forward movement of the movable jaw in order to maintain the arc of the flashing, yet to have available a quick reverse to break the parts away should they stick too soon from too rapid movement of the pressure device. In small shops, it is advisable to install a 75-kw. machine to handle all sizes of tubes up to the largest superheater. If the shop is large enough to keep a small machine busy all the time on tubes up to 3 in., it will no doubt pay to install in addition, a large machine just to handle the superheater tubes as well as any overflow lot of small tubes. While the large machine will handle any size, it is not so rapid in operation on small tubes as the smaller one, and the bulk of flue-welding is on small tubes, less than 10 per cent of the total being represented by the larger sizes for superheaters.



Hospital Work in a Large Machine-Tool Plant

By SANDFORD DE HART
Director of Hospital, the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio.

One of the large problems of the modern plant management is how best to protect employees from sickness and accidents, and keep them up to the highest possible state of physical efficiency. To do this successfully means that work of this kind must be in the hands of skillfully trained, foresighted and sympathetic people.

RECENTLY, an analysis was made to discover, if possible, whether any results were being obtained from our campaign of education on safety, accident and infection prevention.

This campaign extended over a period of five months, starting with May 1 and ending Sept. 30. The analysis disclosed that there was a total of 60 hours lost through injuries incurred in the plant, and since we have on our payroll about 1,000 men, this meant the loss of 3.6 minutes per man, for the period of five months. There was $6.90 compensation paid. The 60 hours lost are classified as follows: In May, 16.2 hours were lost; in June, no time was lost; in July, 10.1 hours were lost; in August, 13.4 hours were lost; in September, 20.3 hours were lost.

It might be well to state that the safety, sanitation and health work in our plant are under the supervision of the hospital department, the personnel of which is small, consisting of the writer, a surgeon, a dentist and a stenographer. It is the aim of this department to exercise close and careful supervision over the human element; just as the engineer exercises over the inanimate machinery technical parts of the plant.

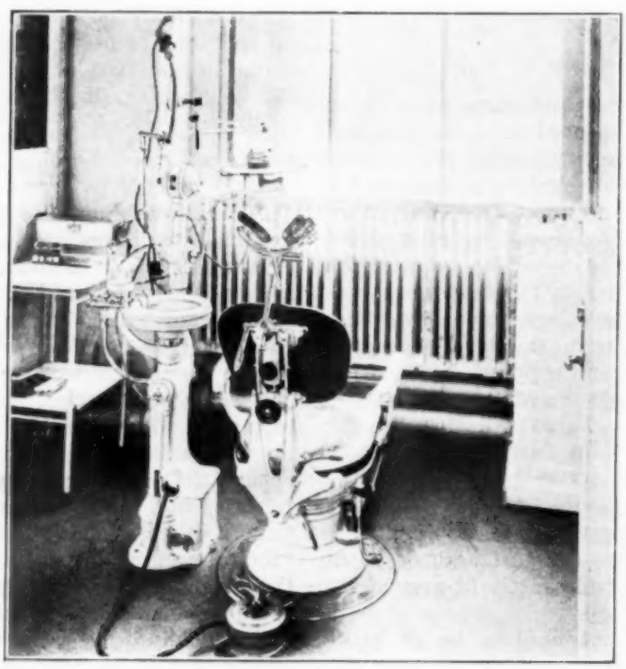


FIG. 2. THE DENTAL DEPARTMENT

Our records show that there were 3,106 cases treated, 1,914 of which were first-class surgical cases, and of this number there was not a single serious accident nor an eye condition serious enough to refer to an eye specialist. The foreign bodies extracted from the eye were for the most part floating particles. Persistent education and impressing upon the men the importance of having these foreign bodies removed before they became adherent to the eye, were largely responsible for our low eye-trouble rate.

The wearing of goggles was made compulsory and every objection on the part of the man using them overcome. We found that the goggles to be effective must fit closely and still allow air to circulate. The

FIG. 1. EYE-TREATMENT APPARATUS

screen covering on the outer border with small perforations and fitting snugly, brought better results than others which did not possess these advantages. However, as the experience gathered showed the goggle question to be more or less a psychological problem, we did not insist on minor details as to its construction. We were primarily interested in the man using protective goggles, regardless of type. Occasionally, we would have a man who would discard his goggles and go over to the grinding wheel to grind tools, only to find that the result of his foolishness was a piece of emery burnt into the cornea of his eye. This would necessitate removal with the aid of a local anaesthetic, dilatation of the pupil, and treatments every two hours until after the inflammatory process had subsided. A shield was placed over the injured eye and the employee kept at work. Our eye-treatment apparatus is shown in Fig. 1.

It was found that by far the greater number of injuries occurred between the hours of seven and nine in the morning, or during the period of adjustment. The accident rate was considerably higher on Monday than it was the balance of the week, with the possible exception of Saturday morning. In our campaign of accident prevention and accident reduction this period of the day received particular attention.

Classification of Injuries

In tne classification of the number of injuries, it was found that 204 men received one injury each and 96 men received three injuries each. Those receiving over 6 to 12 injuries numbered 80, and those receiving over 12 numbered three. The character of the work performed by the injured no doubt accounts to some extent for the percentage of injuries. There were less accidents with men operating machinery than those from falling bodies, lifting, etc. Individual characteristics of the employee had considerable to do with the injury; for instance, the injuries received by the three men with 12 injuries each were not due to the character of the work performed.

The nature of the injuries received for the most part were abrasions. Next in frequency were small lacerations, and after this were foreign particles in eyes. Of the injuries incurred, 86 per cent affected the upper extremities, involving fingers and hands, since these parts of the anatomy are the most exposed to injury. While it is seldom that a new employee does not incur injuries during the first two or three days of his entering our employment, the older employees are not immune to accidents. Occasionally, we found a man who had been working on the same type of machine for many years and practically had mastered every detail of the mechanism and operation, and yet there was that tendency on the part of the man to question the ability of the machine to do him personal injury. Hence his susceptibility to injury was increased. This susceptibility varied greatly with different men although they were engaged in the same class of work.

Causes of Accidents

Many factors enter into accident causes. One cause may be a sleepless night, due to financial or domestic troubles, or to a toothache.

We have established a fully equipped dental office to take care of defective teeth, with a dentist in charge. Our dentist is a picked man, being chosen not only for his professional ability, but also for the keen interest he has shown in industrial work. His business is to examine the mouths of all of our employees periodically, with the view of keeping the mouth in a hygienic condition; in other words, his duties are to anticipate and prevent toothaches, as it is the duty of the safety department to anticipate the occurrence of accidents. Our dental department is shown in Fig. 2.

Perhaps there is no one cause that is more productive of accidents than domestic trouble and difficulties. These difficulties may be due to misunderstandings between a man and a wife, sickness in the family, worry over the actions of children, or to numerous other causes of a similiar nature. To iron out these difficulties is the duty of our welfare director. The men are made to understand that they can come to the welfare director

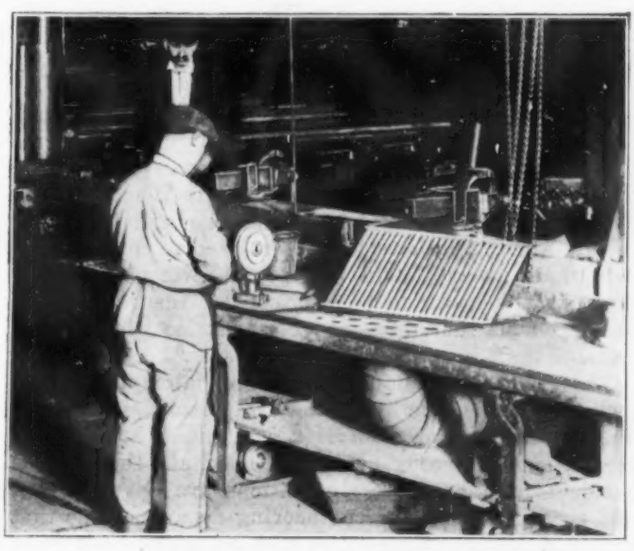


FIG. 3. BENCH GRILLS AND EXHAUST SYSTEM

with their troubles, and that they will receive sympathetic advice and aid. If the conditions surrounding a man's life outside of the plant lowers his working ability, it is just as rational to try to remedy this difficulty as it is to put a machine into working order that has been injured through some unknown cause outside of working hours.

Two departments which have responded very well to our activities along safety lines are the screw-machine department and the paint department. With the screw-machine department we experienced considerable trouble with our men, in their susceptibility to boils and minor infections. We have practically eliminated boils and have not had a single infection from this department in the last five months, or since we have been sterilizing the oil once a week.

With reference to the paint department, this department has always been productive of respiratory and eye troubles. To prevent these conditions an exhaust bench, shown in Fig. 3, has been installed for the painting and filling of machine parts. All of the dust and dirt, lead and other ingredients of the paint are sucked by an exhaust system, through grill work in the top of the bench and disposed of outside of the shop. The main parts of the benches are of the type adopted for work benches, being made up of standard and interchangeable parts, such as legs, drawers, runners and other material. These parts are carried in stock in interchangeable units and assembled as required.

The grills are spaced on about 3-ft. centers and are approximately 3 ft. wide, running the full depth of the bench. They are set in flush with the top of the bench, allowing castings to be readily slid along the bench from one operation to the next. Each of these grills is connected by an independent duct to the main exhaust line which parallels the length of the bench. All of the painting and filling of cast-iron parts, with the incidental rubbing down between the application of various coats, is done on this bench.

All the grinding of small parts with rough edges which the painter would otherwise have to chip off is also done on this bench.

Careful records have been kept and the employees of this department placed under special observation for respiratory and eye conditions. Before the installation of the exhaust system the conditions were more than ordinarily productive of traumatic eye conditions and also respiratory troubles. In the past five months there have been no cases from his department.

The Scope of an Industrial Hospital

An industrial hospital to be efficient must be more than a place to merely bandage fingers. The doctor should be sufficiently familiar with occupational hazards to anticipate accidents. He should be social minded, so that a man will not feel embarrassed to come to him with small wounds, as it is the small wounds that are the most likely to become infected. Insurance companies tell us that there is more time lost through infections than through serious accidents.

The study and elimination of occupational diseases, including those due to industrial poisons, is another duty of the hospital supervisor. He should know which occupational diseases induce or maintain the various accidents and how these conditions are apt to occur, and coöperate with the engineering department so that practical protective measures may be taken. His work is not to determine if a certain man measures up to his job, but whether he is physically able to perform the task assigned to him, or whether there are industrial conditions under which he is working that are harmful to him or his ability.

Efficiency is a synonym for output and there can be no efficiency where there is a likelihood of accidents, nor can there be maximum efficiency where the man is physically unfit to perform the task assigned him.

Designer's Slant on Metric System

By Malcolm S. Cate

In contemplating the metric system, it will be well to consider the chips that will be added to the fires of unrest that are now burning enthusiastically.

I am a humble machine designer whom fate and employers have treated kindly enough so that I do not contemplate taking a running jump into the adjacent Charles River or some equally wet body of water.

If Congress tells me to, I will obediently, if somewhat sullenly, discard such measuring instruments as I now possess, deny my wife her new spring hat, myself my semi-occasional cigar, and invest the amount derived therefrom in replacing my discarded tools with measuring instruments, the subdivisions of which more nearly suit George Q. Meddler (I strongly suspect his name is Von Meddler) and his associates. I will also readjust my life-trained mental process of thinking in feet and inches to thinking meters, centimeters and millimeters, regardless of the headaches engendered thereby, and reattack my work with a necessarily diligent if enwearied manner—and now let me reassert that I am a fairly content and unpugnacious member of the community.

I am acquainted with divers fellow craft who are just sore enough at their jobs that when being confronted with the conditions presented above, and an unheard of number of designs, drawings, sketches and computations which they have once completed and thankfully forgotten and which must be laboriously altered, will retire from their trades with an abandon which will border on frenzy and go into snow shoveling or some other equally exhilarating and remunerative enterprise. So much for designers and draftsmen who have never been considered of hefty importance in the general industrial scheme. Now let us come to the machinist and other workmen and we have something else again.

A friend of mine who is a machinist (a draftsman of proper diplomacy and servility may have a friend or two in this trade) has recently acquired a vernier caliper for which he paid in the vicinity of forty dollars in the best coin of the realm. To say that he is proud and jealous of this instrument would be hardly broaching the subject. When Congress tells him that this instrument is of no use and he must drop it into the nearest ash can, he will do it with a carefree cheerfulness; will he not. By altering the position of the first two words of the last phrase of the preceding sentence, you will get the right answer.

Likewise, when all of the machinists of this country are ordered to deposit their measuring instruments in the National junk pile, composed of jigs, fixtures, tools, patterns and templets, there will be a roar compared to which a full-grown artillery preparation would be a whisper. Yes,—and could you blame them?

In closing, let me arise to ask: Why add straws to the back of the camel whose knees are already wobbling?

The Printing Press as an Aid to the Drafting Room

By F. H. PFEFFERLE

In most instances drawings must go through two or more stages before blueprints can be made from them. Pencil drawings may or may not be inked in for tracing and in some cases tracing may be omitted and the blueprint made from the pencil drawing direct. However, any part of the routine that can be saved is a distinct gain not only in dollars but in the time in which a drawing can be gotten ready for the shop. In this article the author describes and illustrates a method by which a printing process can be used to save much of the repetitive work required in tool designing.

NOW that machine-shop production has been standardized, attention should be turned toward the drafting room. If it is unprofitable for a man to do mechanical work that a machine can do for him, it is just as unprofitable for a draftsman to draw what a machine can draw for him.

When the war emergency required that drawings be completed in the shortest possible time, some firms resorted to making blueprints directly from pencil drawings, which were made on vellum paper. This method cut down the work considerably but there was still left the drudgery and loss of time that accompanied the making of a large number of drawings that were alike except for a few important details.

The problem of making a great many similar drawings confronted the National Cash Register Co., Dayton, Ohio, when it began to build its own tools. The designing of a large number of drill jigs was an important item. Most of these jigs were alike, except for the method of clamping the work to be drilled, so that whenever a new jig was designed the body of the jig had to be redrawn. While watching a man working on a half-dozen drawings of the same jig, the foreman conceived the idea of printing the jig bodies instead of drawing them over and over again. A jig body was immediately drawn up and sent to the printing department, where a photo-engraving was made on a zinc plate and a number of copies printed. Fig. 1 shows two views of the body of a single-hole drill jig as printed. After the "vitals" and the method of clamping a particular shaped object have been drawn in with pencil, the assembly appears as in Fig. 2. The numbers *1*, *2*, *3*, etc., indicate the various parts of which details are to be made, while all stock parts are listed in the space provided below. The piece to be worked on is designated by dot and dash lines. In this case it is a cylindrical stud which is clamped in a V-block by a screw and bell crank device as shown. A hole is to be drilled $\frac{1}{16}$ in. from the end of the stud. When the piece is drilled, the clamp is loosened and pushed aside as indicated by the dotted lines.

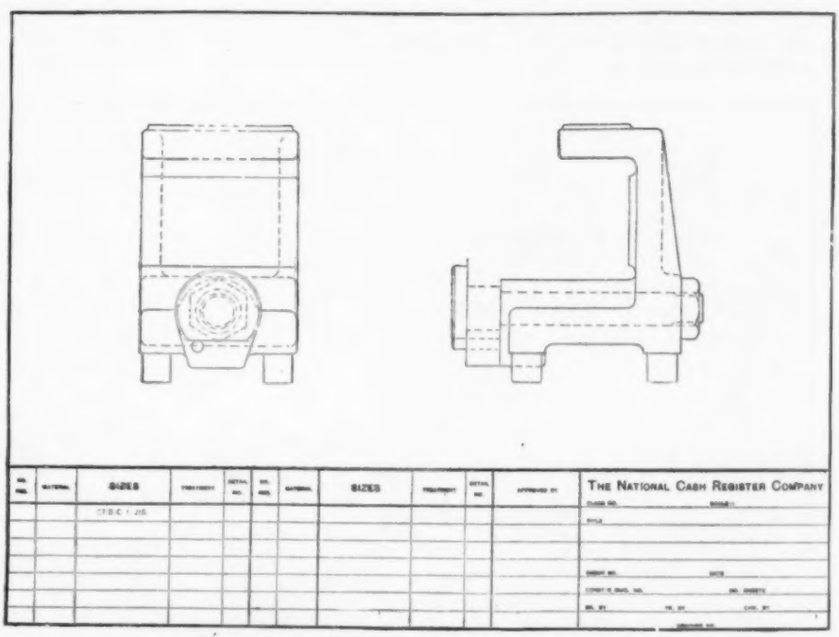


FIG. 1. PRINTED OUTLINES OF A JIG BODY

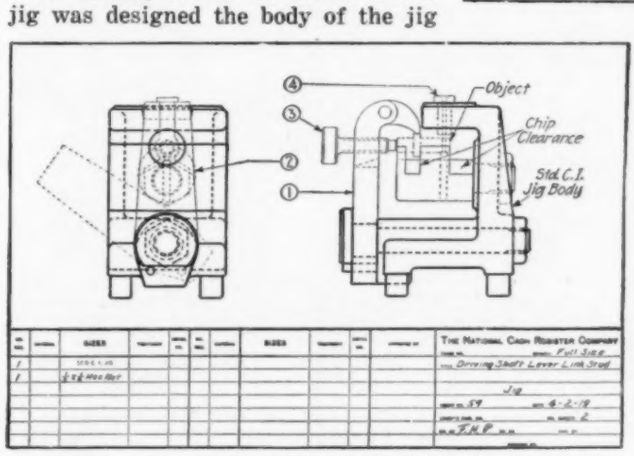


FIG. 2. JIG ASSEMBLY USING FIG. 1 AS A BASE

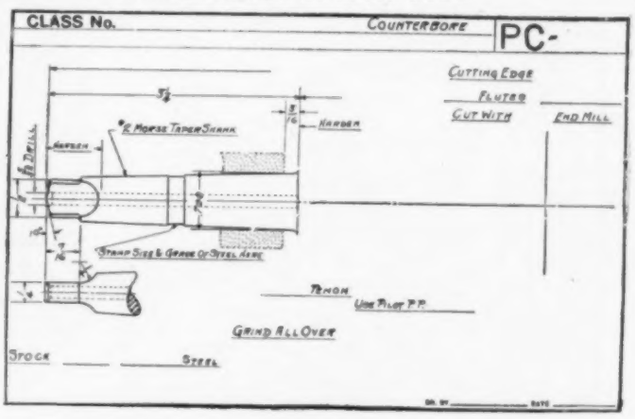


FIG. 3. OUTLINES AND DIMENSIONS OF PAPER SHANK

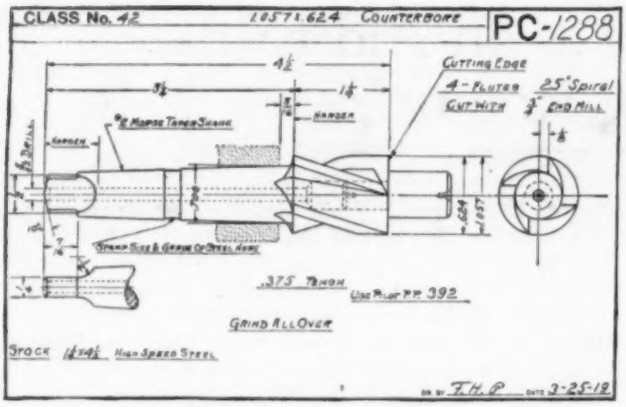


FIG. 4. DRAWING OF A COUNTERBORE USING FIG. 3 AS A BASE

This facilitates its removal, and the insertion of a new piece. Instead of being inked in, the completed pencil drawing is shellacked and sent to the shop. Thus the drawing has been completed in less than one-fourth the time formerly required. Thousands of parts can be drilled every day on a jig of this sort, so only one will be needed. To ink the drawing and to make a blueprint of it would be a mere waste of time.

This same method of making drawings has been even more successfully applied to small tools, such as reamers, end mills, counterbores, etc. Hundreds of such tools are designed every year. All of these have standard taper or straight shanks. The shank is not drawn every time a new cutter is required but instead a series of standard shanks of various sizes have been printed on vellum paper. Fig. 3 is an example of a shank for a counterbore. It will be noted that nearly all the dimensions and lettering are already on the plate, and it is only necessary for the designer to draw in the desired cutter and the few remaining dimensions. Fig. 4 shows the complete drawing, which having been made on vellum paper is ready to be blueprinted. With this method only two steps are necessary to make a print ready for use in the shop.

Another important use to which printed forms are put is in the designing of automatic screw-machine cams. Every single-spindle automatic screw machine has at least three cams. A front cam, which operates the front cutter, a back cam which moves the rear cutter, and a lead cam for revolving the turret. In laying out these cams it is necessary to keep in mind the exact position of one cam with relation to the others. To make clear this relationship at all times, the three cams are very often designed one on top of the other. To eliminate the complication which results from such a procedure, three forms, each of which is divided into 100 parts, are printed in red ink on a sheet of vellum paper. In this way each cam may be designed independently, but still the draftsman knows the exact relation of any point on one cam to any point on the other two. Fig. 5 shows the back and lead cams, for a single-spindle Brown & Sharpe screw machine, to be set up for making a small

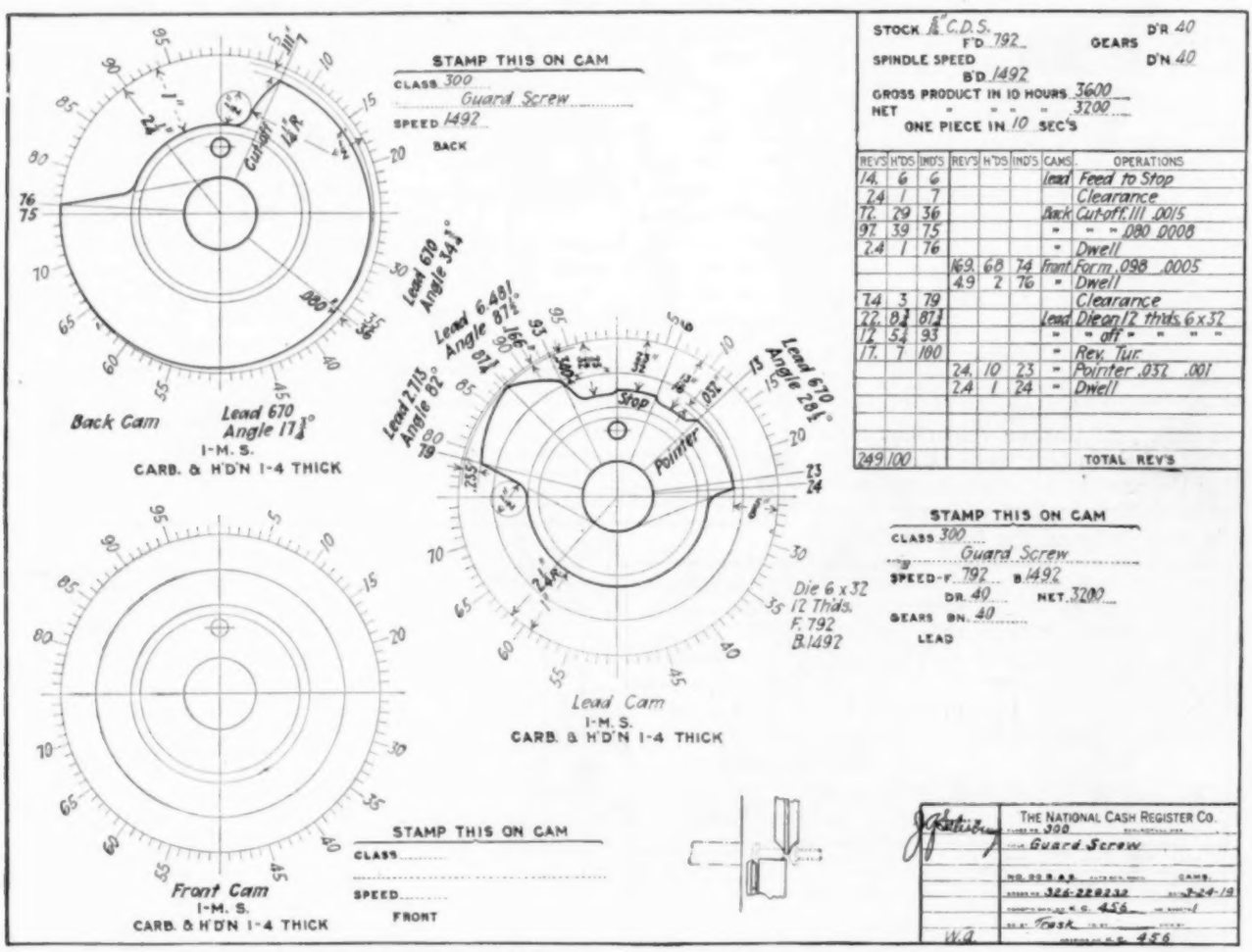


FIG. 5. PRINTED GRADUATED CIRCLES ON WHICH TO LAY OUT CAMS

guard screw. The front cam was omitted to illustrate the printed form on which the cams are drawn. Below the lead cam is shown the forming and cut-off tools at work. The leads and angles which are given at different points along the cams are the leads of the milling-machine table and the angles of the dividing head to be used in cutting the cam. In the block in the upper right-hand corner is noted the complete data of the action of the cams in turning the guard screw. The great simplification in the designing of cams which results from the above method is obvious and can be used to good advantage by every firm operating automatic screw machines.

This method of printing drawings is also used for standard die shoes and die holders, multiple-hole drill jigs, milling cutters and a number of other stock tools and parts. The saving of time resulting from making drawings in this way has paid for the cost of the photo-engravings many times over every year. Fewer men are needed to do the work while the elimination of the drudgery has greatly increased the efficiency of the tool-designing department.

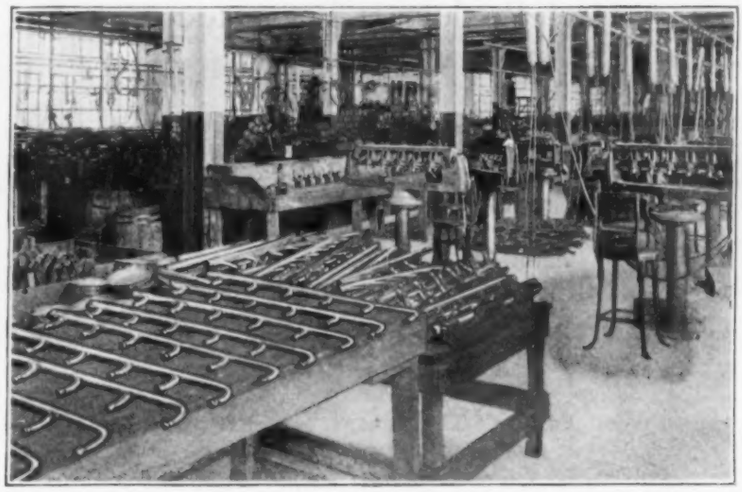


FIG. 4. COMPLETED MANIFOLDS FOR LIBERTY ENGINES

Oxy-Acetylene Welding Fixtures for Making Manifolds

By C. C. Phelps

Several ingenious fixtures are employed to great advantage in manufacturing manifolds for the Liberty engines by means of the oxy-acetylene process at the plant of the Ireland & Matthews Manufacturing Co., Detroit, Mich. The fixtures were designed in accordance with plans furnished by the engineering department of the Oxweld Acetylene Co., Newark, N. J.

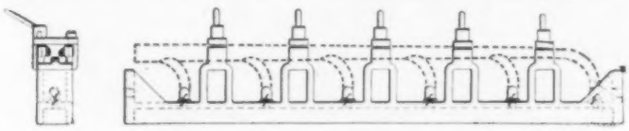


FIG. 2. DETAILS OF FIXTURE PROPER. ASSEMBLED MANIFOLD INDICATED BY DOTTED LINES

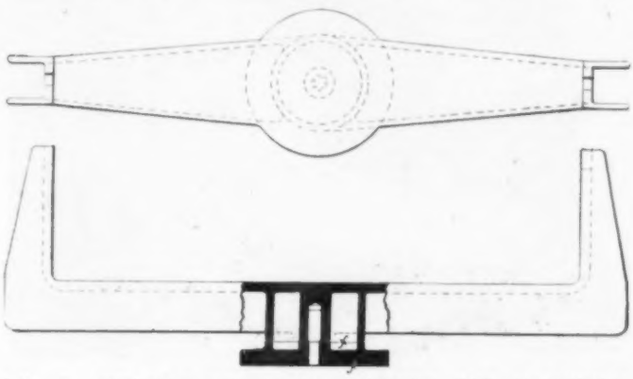


FIG. 3. DETAILS OF SWING SUPPORT FOR MANIFOLD WELDING FIXTURE

In assembling the manifold parts in the fixture, Fig. 1, the five branch inlets are first mounted on their respective pivots *A* in the bed of the fixture; the trunk of the manifold is then placed above and in contact with the branch lines, so that the openings in the trunk coincide with the ends of the branches, and, finally, the five hinged clips *B* are swung into position and clamped down on the assembled manifold by means of the nand clamps. The end of the trunk is bent to serve as one of the inlets and this end in turn is inserted over the end pivot. The fixture shown in Fig. 2, serves to hold the assembled parts in perfect alignment.

FIG. 1. FIXTURES USED IN WELDING LIBERTY ENGINE MANIFOLDS

The fixture proper is suspended at the ends to permit complete freedom of rotation, and the points of suspension are so located that the device will be in balance when containing the tubing. The support for the fixture, Fig. 3, is mounted on a pedestal in such manner as to allow rotation in a horizontal plane. Thus the operator is enabled to shift the work so that the blowpipe flame can be applied in the most advantageous manner at all times. Fig. 4 shows the completed manifold.

During the war this company manufactured various kinds of tubes and manifolds for Liberty and Le Rhone engines, bombs, gas shells, floats for the Navy and poison-gas tanks. When it is considered that the company had no welding equipment prior to May, 1918, great credit must be given to the inexperienced girl operators and the equipment that produced such results.

A High-Production Pneumatic Milling Fixture

By P. A. Udall
Chief Tool Designer, The Holt Manufacturing Co.

Fig. 1 shows a pneumatic milling fixture, designed for the Holt Manufacturing Co.'s first motion chain pins, straddle-milling both ends to a depth of 1¼ in. and using 1¼-in. diameter cold-rolled steel cut in 6-in. lengths. This fixture, Fig. 1, mills 16 pins at once, with a dividing bar *A* in the center to enable the operator to take out and replace the first eight pins while he is finishing the rest.

I am using a 4-in. piston with 100-lb. pressure. The piston plunger is 1 in. in diameter, tapered on the end to about 24 deg. This taper works between two toggles, with a reduction of two to one, as shown at *B*, top plan, developing a pressure of 2,400 lb. on each pin. An eccentric pin *C* is provided to take up wear.

A snap dog *D* with a square stud underneath locks the revolving fixture on either side, as shown at the left-hand side of the drawing, and on the right-hand side a similar dog is provided, but this one is locked and released by a thumb screw instead of a spring.

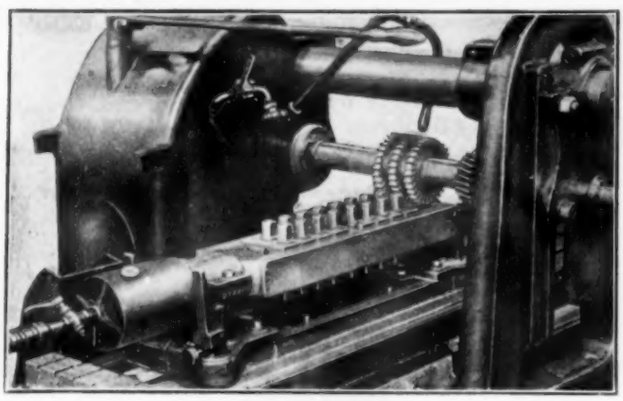


FIG. 2. FINISH OF FIRST CUT

This gives the operator a chance to release or lock the thumb-screw dog *E*, so that he can release and revolve the fixture by handle *F* and spring dog *D*, locking thumb screw *E* when the feed is started.

The V-blocks are made for two rows of pins and spaced so that they take a standard width of cutter in the center, using any width of cutter on the outside.

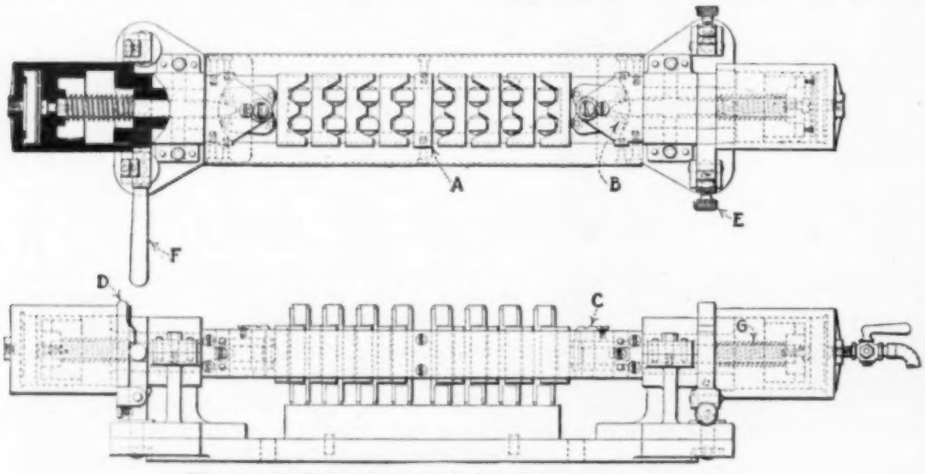


FIG. 1. PNEUMATIC MILLING FIXTURE ASSEMBLY

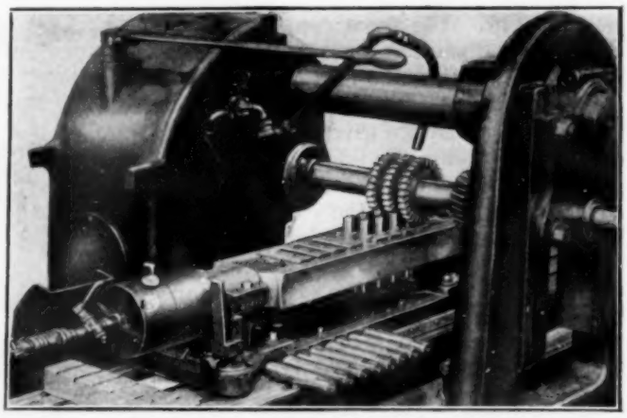


FIG. 3. FIRST EIGHT PINS FINISHED AND REMOVED

The most important feature in this fixture is that any desired pressure can be applied on the V-blocks by changing the taper of the piston plunger *G*, and, with this arrangement, both rows of pins are held with an equal pressure, tightening its grip by the vibration of the cut. This fixture milled 1,200 pins on both ends in 8 hr., the fourth day after its completion and no doubt it will show still better results.

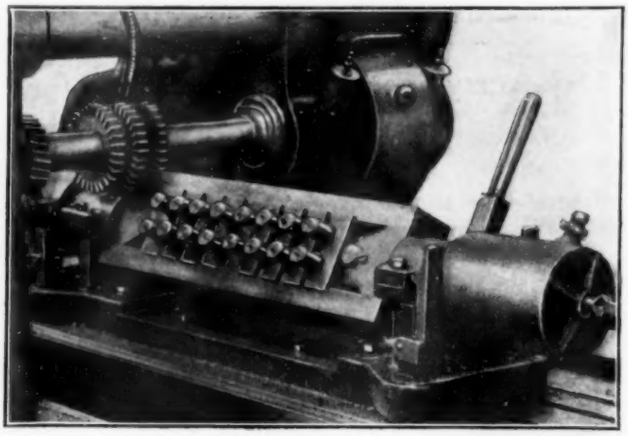
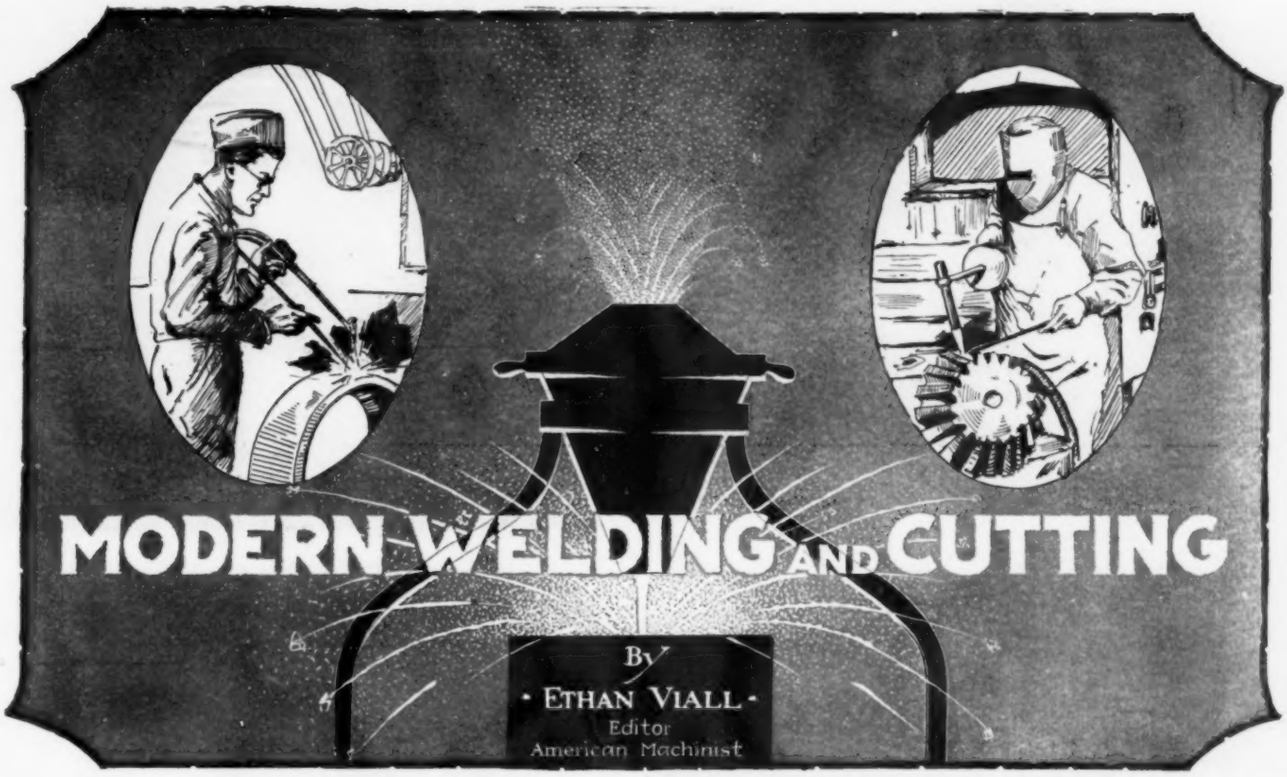


FIG. 4. REVOLVING THE FIXTURE

Figs. 2, 3 and 4 show the fixture when in operation. Fig. 2 shows the first cut just finished; Fig. 4 shows the fixture from the other end being revolved to mill the other side; Fig. 3 shows the first eight pins released and already taken out.

The Beacon Falls Rubber Shoe Co. in order to induce its force to be punctual and work steadily, adopted the scheme of paying a dollar a week bonus to any employee who had a perfect time record for a week. This resulted in reducing the absentee record by nearly 30 per cent. One executive has said that nearly 90 per cent of all lateness—a big factor in industry—is habit. There are probably other good ways to break the habit.—*Factory.*



XX. Welding Jigs and Fixtures*

The various devices shown in this article will be found suggestive of others that may be applied to almost every conceivable repetition job.

(Part XIX appeared on page 603, last issue.)

WHERE a welding shop does a general line of work which includes everything that comes, there should be an ample assortment of drilled straps, angle irons, bolts, V-blocks, clamps, plates and the like. Good supplies of fireclay and plaster of paris are also very desirable for supporting or holding irregular work that is apt to collapse or get out of line. Many times, a table such as shown in Fig. 234 will answer for certain jobs. The top of this table is made of a "grated" slab of cast iron supported on a welded angle- and strap-iron frame. The slots provide means for the insertion of clamping bolts. A table similar to this can easily be made in any welding shop.

Pipe welding is a very common and re-occurring job in most shops. Some rig up V-blocks, rollers or other devices, but the method shown in Fig. 235 is very good.

*For the author's forthcoming book on "Welding and Cutting." All rights reserved.

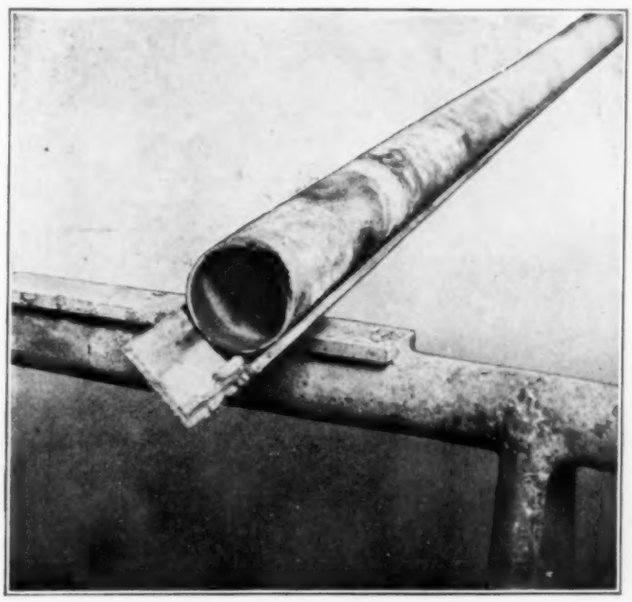


FIG. 235. HOLDING PIPE FOR WELDING

FIG. 234. TABLE FOR HOLDING WELDING WORK

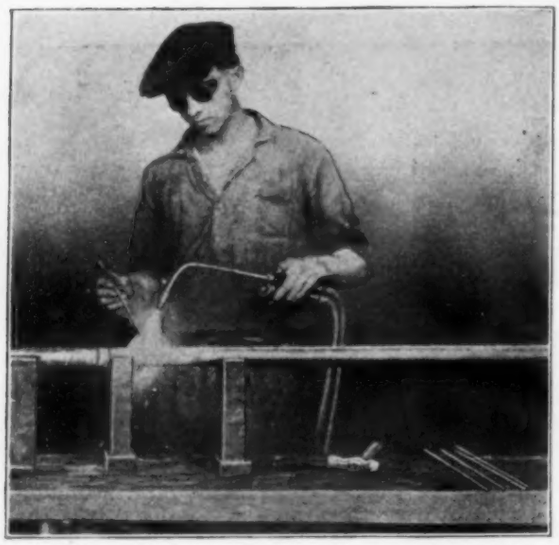


FIG. 236. V-BLOCKS FOR HOLDING SHAFTS

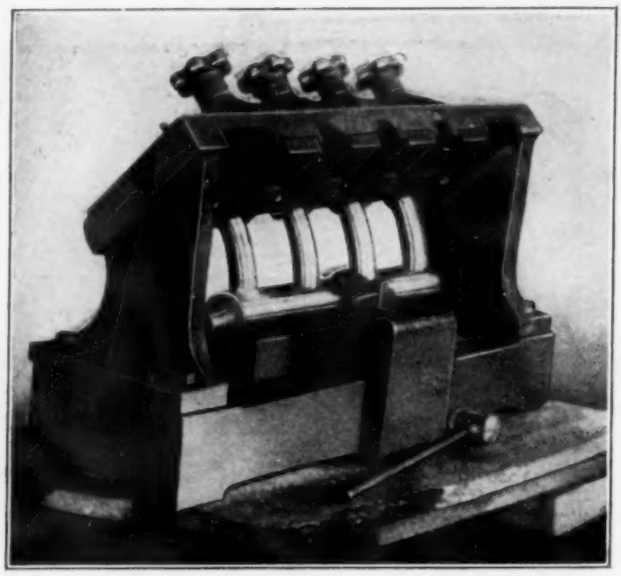


FIG. 243. MOTORCYCLE MANIFOLD WELDING JIG

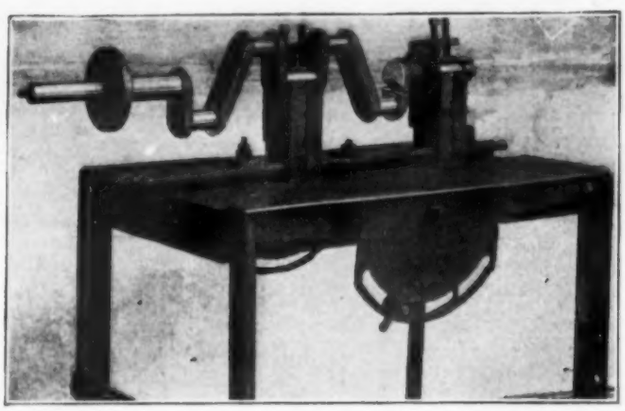


FIG. 238. AN ADJUSTABLE CRANKSHAFT JIG

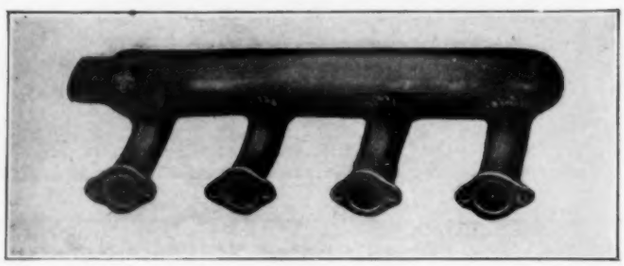


FIG. 244. A WELDED MOTORCYCLE MANIFOLD

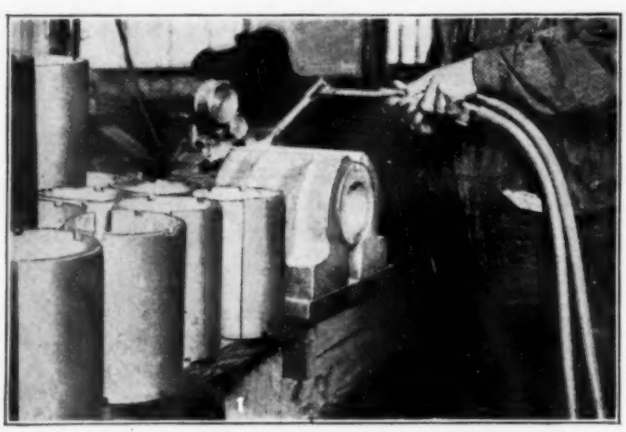


FIG. 245. A SHEET-METAL ROLLER WELDING JIG

FIG. 239. WELDING A BROKEN WEB IN THE JIG

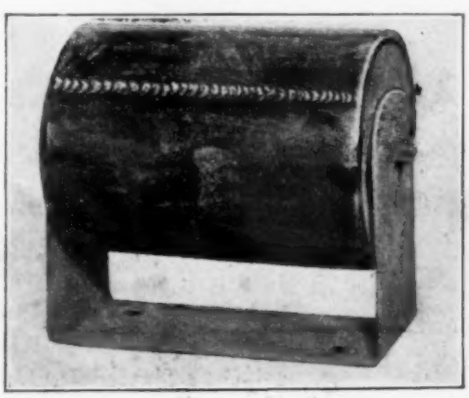


FIG. 246. A WELDED CONVEYOR ROLLER

It is simply a piece of angle iron placed on iron horses as illustrated. The ends of the pipe to be welded are cut square and the outside ground back for about two or three inches to remove rusty scale and dirt. On long pieces of pipe the grinding may be done with a portable electric grinding machine while the end of the pipe sticks out a foot or so from the end of the channel iron. The pipe in this case remains still and the grinding machine is moved around it as the operator stands

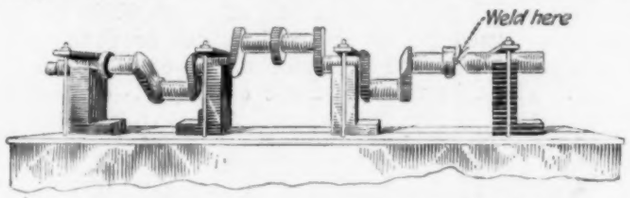


FIG. 237. JIG FOR HOLDING CRANKSHAFTS

in front of the pipe end. The short or easily handled pieces of pipe may be ground on a stationary grinding machine.

The best part about using an angle iron is that the pieces of pipe to be welded are held in line while being tacked together. On ordinary sizes the welder will have no difficulty in turning the pipe as he welds. On heavy pipe some form of rollers will be found very convenient.

A very simple way to weld straight shafts is shown in Fig. 236. Here the shaft simply rests on high V-blocks which keep it in line but do not interfere with expansion or contraction.

A jig for holding a motor crankshaft broken in the shaft, is shown in Fig. 237. The main part of the crankshaft is clamped to three V-blocks. The bases of these V-blocks are grooved to fit over a tongue in the baseplate, so that they may be slid along in order to adjust them to various sizes of crankshafts, and yet keep them in line. The V-block holding the short piece to be welded on is made in the same way, but the piece should *not* be clamped in solidly but should be so held that it can move lengthwise. This may be done by clamping loosely or else having the V-block free to move along the tongue. The rigid clamping of all parts would cause distortion and springing of the crankshaft.

The device shown in Fig. 238 is in use in the Oxweld shop. Four V-blocks are made to slide in a channel in the table and may be clamped wherever desired. Each V-block carries its own clamping screw for holding the

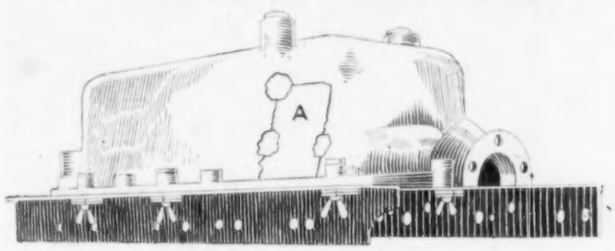


FIG. 240. ALUMINUM CRANKCASE STIFFENED BY ANGLE IRON

work. For ordinary shaft welding the table may be used in a horizontal position, as shown, but for welding breaks in webs the table may be tilted as shown in Fig. 239. This illustration also shows the use of a coal-gas and air torch to heat the work while the welder is using the welding torch.

Crank cases or other automobile parts may be held in order to prevent distortion as much as possible, as shown in Fig. 240. In this case angle irons and short bolts with wingnuts are all that are needed. The patch to be welded in is shown tacked in place at *A*. Another application is shown in Fig. 241. The patch *B* has been tacked in two places ready for welding.

In Fig. 242 both angle irons and mandrels are used in the bearings. These mandrels may be solid or of

FIG. 247. LARGE SHEET-METAL CYLINDER WELDING JIG

FIG. 248. APPARATUS FOR WELDING ENDS IN CYLINDER OR TANKS

pipe to fit the bearings. Sometimes, where it is necessary to keep the bearings cool, a pipe with elbows screwed on each end may be clamped in. With the ends of the elbows up, the pipe may be filled with water.

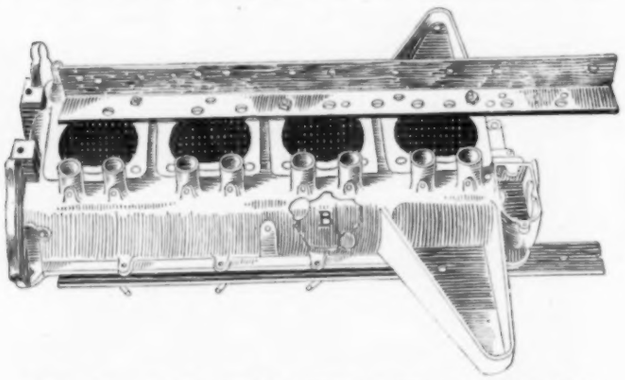


FIG. 241. ANGLE IRON APPLIED TO ANOTHER JOB

The Henderson Motorcycle Co. uses the jig shown in Fig. 243 to hold the parts of their exhaust manifolds while welding. The construction and operation are obvious. A welded manifold is shown in Fig. 244.

Holding Sheet-Metal Cylinders

A very simple welding jig is shown in Fig. 245. This consists of four castings: the base, two side pieces and the hollow mandrel. The cylinders welded are 6 in. in diameter and 8½ in. long, made of ¼-in. plate. They are used to make the conveyor roller shown in Fig. 246. The seam is welded in three minutes.

Another cylinder welding jig is shown in Fig. 247. This is in use in the Thermalene shop. The edges of of the cylinder to be welded are held up to the V-channel from underneath by a bar locked in place by bolts and large wingnuts.

The speed for welding sheet metal will of course vary widely, but the following approximate results on sheet iron and steel are a fair average:

Thickness of metal	Feet per hour
20 gage	40
18 "	35
16 "	30
14 "	24
12 "	22
10 "	20
8 "	18

The welding of steel barrels of about 30 to 35 gal. capacity, used for oil or gasoline, can be done by an operator of average skill at the rate of 16 to 18 per day. These barrels are made of 12-, 14- or 18-gage

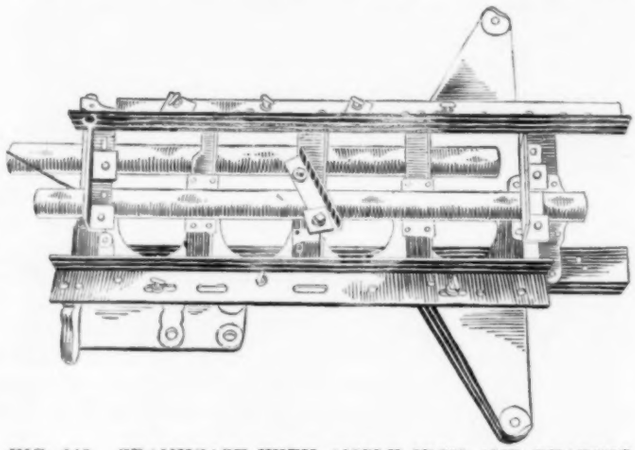


FIG. 242. CRANKCASE WITH ANGLE IRON AND BEARING MANDRELS IN PLACE

sheet steel, and require one seam weld, two complete end welds, two bungs welded in and a reinforcing ring welded on each end.

In welding the ends on cylinders or drums, the device shown in Fig. 248 is sometimes used. The work

FIG. 249. WELDING POISON-GAS CONTAINERS

rests on a turn table which is rotated by the welder's foot. A supporting arm and a suspension spring assist the welder in holding the gas torch.

The method of welding gas containers for war use with Oxweld apparatus is shown in Fig. 249. As shown at the right, the container bottoms are welded in while resting on rollers set on an inclined base in such a way as to present the work at the right angle.

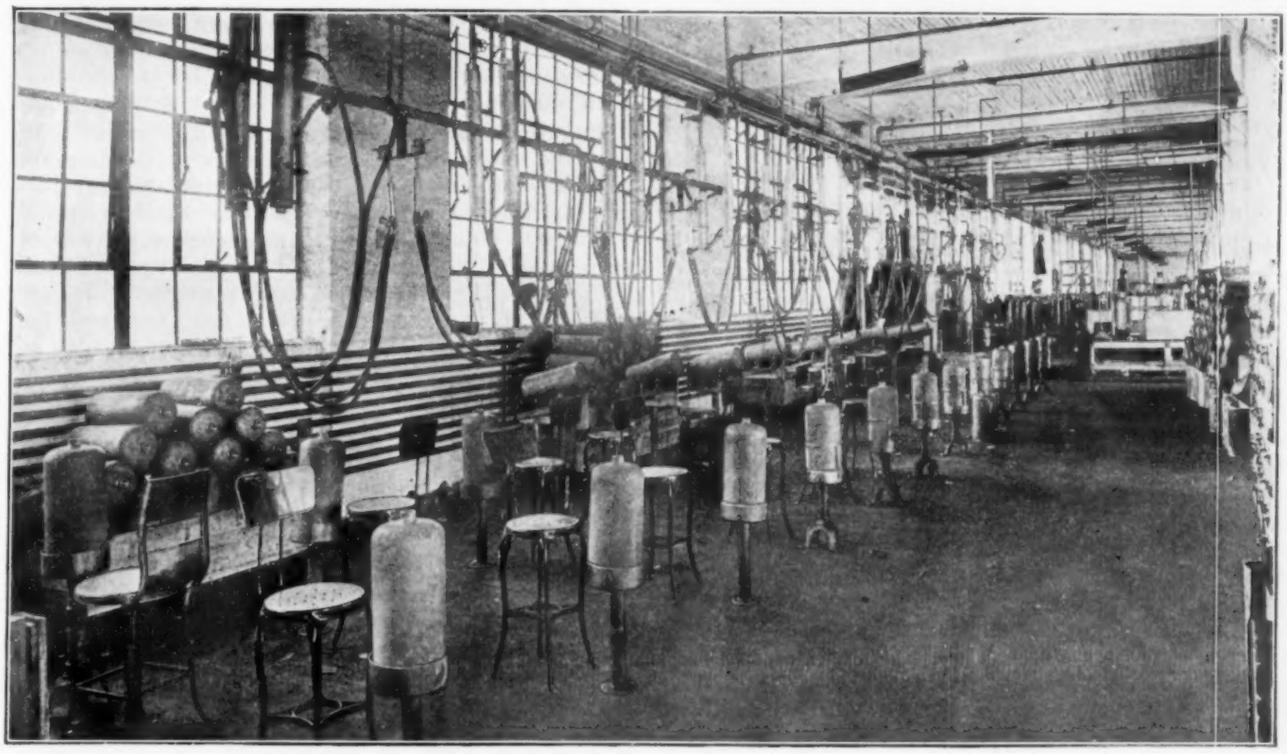


FIG. 250. ANOTHER VIEW OF CONTAINER WELDING DEPARTMENT

Fig. 250 gives a better view of the bung welding apparatus, and also shows the excellent method of suspending the torches when not in use.

"Prices Are Coming Down"

"The same economic forces that have sent prices up will also operate to bring them down," said Calvert Townley, president of the American Institute of Electrical Engineers and an executive of the Westinghouse Electric and Manufacturing Co., in a recent address before a meeting of the Schenectady Section.

"Prices are up because wages are high; wages are high because, due to the war, the demand for labor is greater than the supply. Much has been said about the existence of a 'new order' of things that will permit working men to demand hereafter a greater reward for their labor, but there is no indication of a new order in the facts. The workingman is using today precisely the means to gain his ends that he has used for years, and that he is far more successful in gaining these ends than he has been before is simply due to the present abnormal economic conditions and not to any revolutionary changes in human society.

"As long as America is called upon to supply a large share of the world's commerce, our factories will be kept busy, wages will stay high, and so will prices. But as soon as the European industry begins to function properly and the demands of commerce shall have again become normal, it seems reasonably certain that there will be an excess of production over consumption and some nations will lack a market.

"Translated, this means that the supply will be greater than the demand and wages and prices will fall.

"It is then that the test will come. If the United States shall have used its period of prosperity to prepare for depression by reducing costs of production and by teaching its people economy and thrift, the readjustment may come perhaps without any serious disturbances and we may save a good share of what we have gained by our running start.

"But if we sail serene'y on, ignoring the possibility of a coming storm, if we continue the policy of working less and less and paying more and more while Europe buckles to, the resulting depression with its period of unemployment, suffering and possible panics is appalling to contemplate. Then prices and wages will come down suddenly, and with a thump—such a thump as the country has never before known.

"Men who have been trained to think straight and speak clearly must do what they can to show up the idiocy of dwelling in a fool's paradise. Dispel the bogey of class control. Brains have always ruled the world and always will. Show that we are dealing with a perfectly normal problem which must be solved in conformity to well-known natural laws and not with any mysterious unknown or novel principles, or with newly discovered rules of life. No organized minority created for the avowed purpose of taking from the majority some of its property or just rights can long prevail. Witness Germany's effort to subjugate the world. The law of supply and demand will ultimately just as surely bring down the cost of living and wages as it put these items up. The only uncertain features are the time when the changes are to occur and whether these costs and wages shall be brought down in an orderly and gradual manner or whether they shall come down amid disaster and distress."

British Thomson-Houston Magneto Methods

By I. W. CHUBB
European Editor, *American Machinist*

It was with some dismay that Great Britain found herself in the early days of the war almost entirely dependent on her chief enemy for magnetos for use with internal combustion engines. While it is true that one or two British firms had more or less successfully entered the field, progress was not very great, and the opportunity at the outbreak of war was seen and seized by several firms who had previously been experimenting with magnetos for automobile use.

A BRANCH works of the British Thomson-Houston Co., Ltd., in Coventry was devoted exclusively to magneto production, supplemented subsequently by an output from another works at Willesden, London, N. W. More than one type of machine was made including the ordinary Bosch type of pre-war days. Magnetos of the sleeve inductor type with fixed armature (the inductor rotating at engine speed in the case of an eight-cylinder magneto or at three-quarter speed for a six-cylinder magneto), were also produced. Some 18,000 magnetos of this type were produced before changing over to the polar inductor magneto, having a stationary armature and being suitable for 8- to 12-cylinder aircraft engines.

These magnetos have some special advantages for aircraft-engine purposes, the mechanical design giving ease for dismantling and, as four sparks are produced per revolution, the magneto runs at half the speed of the rotating-armature type. Further, the inductors are fixed on a straight-through shaft, thus resisting the effect of engine vibration better than is usually possible. Safety spark gap electrodes are carried and, being rotated constantly through the air, prevent undue ionization. A number of other features might be mentioned, and it may be stated that during the last 18 months of war there were made and supplied some 25,000 of these magnetos, mainly for eight-cylinder engines.

By the courtesy of the British Thomson-Houston Co. the writer was recently enabled to spend some time in its Coventry works and to witness the process of manufacturing these magnetos.

The machines are placed in the order of sequence of operations on components as far as possible and, up to the armistice, at least, the work in its progress through the shops did not deviate from a straight line. This, however, is not possible without some exception in a time of transition—when magnetos of more than one type are to be produced and the quantities of each type required in a given time cannot be accurately known. In certain instances—as for example, the grinding section—an exception is made because the work may need special attention. The same applies to bench lathes, where men are required in charge who are specially versed in bench-lathe methods. Bench machines are, in fact, largely employed in one section, as affording a better method of handling relatively small details such as the contact-breaker lever shown in Fig. 1, in which is shown the complete series of machining processes.

First the drop-forging has a central hole drilled in it in a bench lathe, in which the boss is turned and faced, as shown in the next two views. The piece is next milled on the side at the contact end and then on top, being in the sixth operation slotted for the fiber heel; in the seventh it is milled for the contact points, and then finally drilled and tapped at the same end.

The magneto parts are made as units or sub-units, and where two pieces have to be assembled together as a sub-assembly they are made in the same shop and proceed in parallel lines until they meet at a given point for assembly. Throughout the shops an endeavor

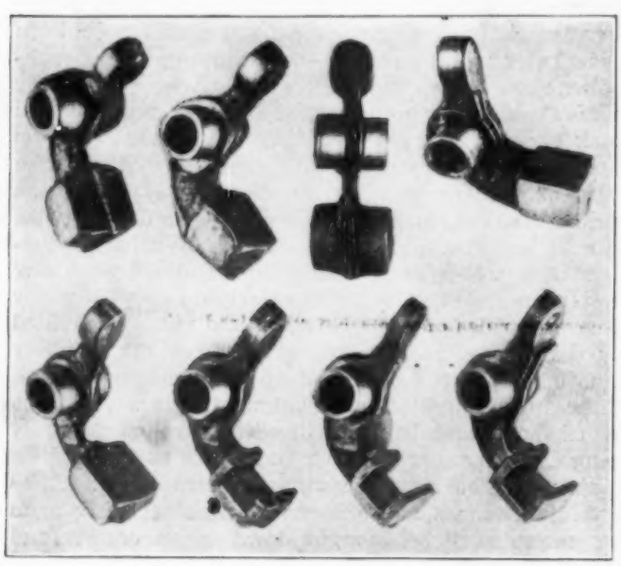


FIG. 1. STAGES OF WORK ON CONTACT-BREAKER LEVER

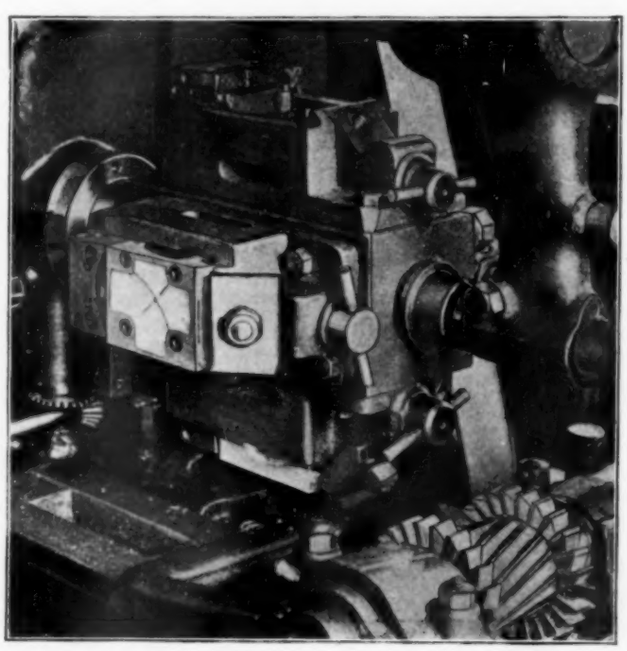


FIG. 2. MILLING ON A GEAR-CUTTING MACHINE

is made to keep everything orderly, and for gangways the not uncommon expedient is used of painting lines in order that clear ways may be kept.

The parts are moved from place to place in wooden boxes. Each box is specially divided to suit the detail it is to contain, but all boxes are of the same size so that they can be readily stored and the number contained readily counted. Stands at the machines are provided, an attempt being made to get the boxes containing the parts at convenient height for the operator. In the grinding section a suction system of grinding-dust removal is employed, this being put into operation every time a given grinding machine is working dry.

Reference has been made to the gearing. The cutting is an ordinary job on a Fellows machine with four to six blanks piled up. The test for the teeth is by

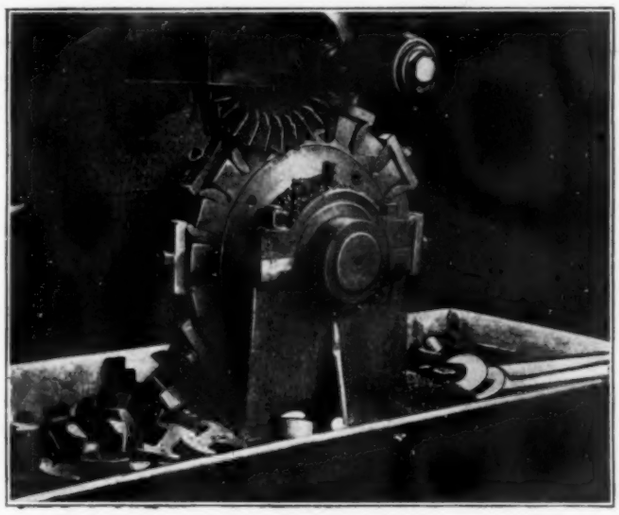


FIG. 3. MILLING ARMATURE END-PIECES

measurement over four wires. This, however, is not found completely satisfactory and is supplemented by testing each wheel in mesh with a master wheel, the gears being run in pairs at correct center distances; this test shows whether the gears will run easily—a fact which cannot be determined simply by the wire test. It is usual to run four wheels, two large and two small gears together, and then the pairs in combination.

It is hardly advisable to describe the whole of the machining operations; in large part they follow closely, and in fact may be regarded as ordinary good practice. A rotating fixture, Fig. 2, used in milling the housings will be of interest; in this cut a gear cutting machine will be seen adapted for the purpose. The operator both loads and unloads the work from the front of the machine, and the fixture has four stations, one only of course being operative. The work is held in position by means of an inclined clamp as shown at the right of the fixture. When tightened up this clamp tends both to force the work toward the opposite end of the fixture and also to pull it down to its seat. A serrated jaw at the end opposite the clamp also tends to pull the work down on to the seat and, further, will swivel a certain amount to allow for small inequalities of the work. The job is simultaneously milled both on the base and on the sides, and it may be worth noting that the work is of an aluminium-copper alloy containing not more than 1 per cent. zinc.

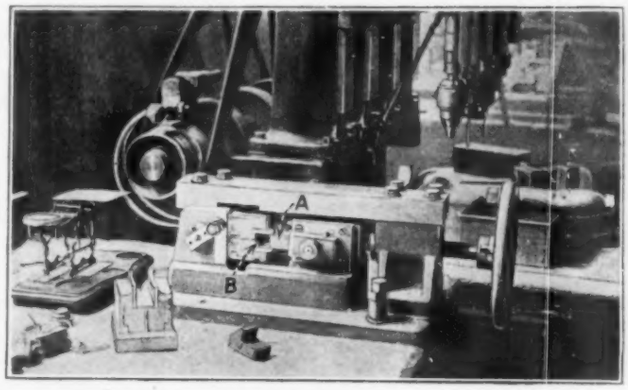


FIG. 4. ASSEMBLING POLE PIECES

A rotating fixture, Fig. 3, is employed in milling the two sides of the armature end pieces, this being the first operation. The clamping arrangement is obvious.

Fig. 4 illustrates the assembly of pole pieces. These are of high resistance iron laminations assembled together in about the required quantities by weighing. The laminations are first assembled at *A* in the fixture and then forced into the body by a screw and handwheel, the gap for them in the body at *B* having already been milled. When the laminations are in position a drill is run through both a hole previously drilled in the housing and the hole punched in the lamination so that the rivet will be a good fit. There are several sizes of holes to be catered for here and the work is done on a four-spindle drilling machine so that there need be no change of drills. It may be added that for brass or aluminium housings beeswax is employed as a lubricant when drilling.

An electric riveting or rather heating arm is used in connection with the core of the rotating type of armature. The core is clamping in a vise, the fixture forming part of the circuit and being controlled by a switch. The hanging cable, with a copper head added for weight, is then held over the pin to be riveted, which is almost

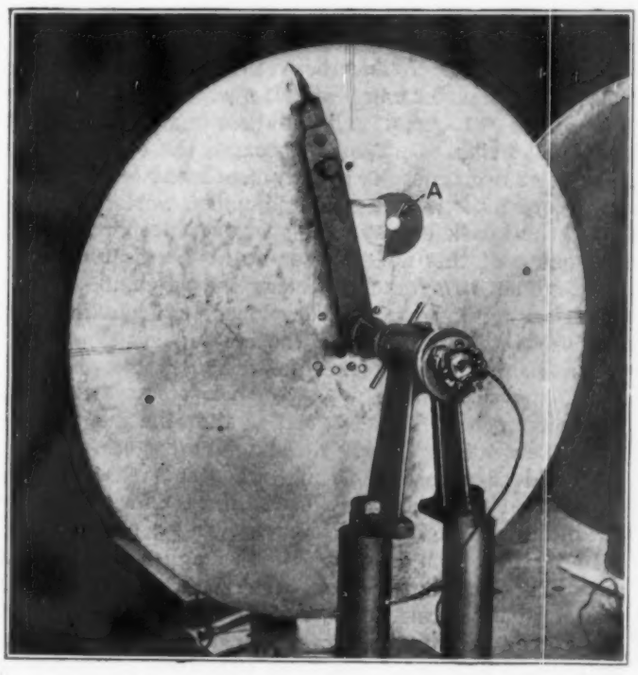
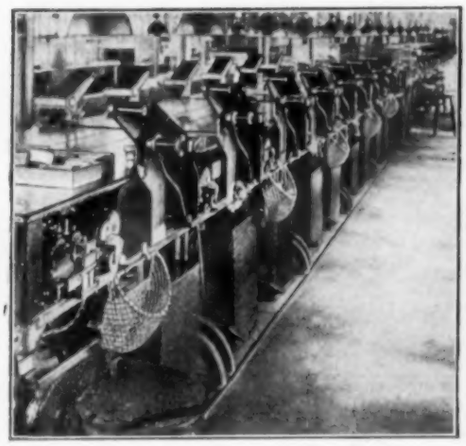


FIG. 5. FIXTURE FOR TESTING CAMS



FIGS. 6 AND 7. THE WINDING MACHINES

immediately raised to the heat required, the actual riveting processes however being done with a hammer. Steel rivets are used in the shuttle armatures, and up to ½-in. diameter are heated in this way. Low-tension electrical devices of this type are fairly common for local heating in electrical shops, though of course in mechanical shops it is not usual to heat rivets in this manner.

The disk, Fig. 5, is used when testing the cams. The cam is slipped on a spindle which carries an indicating arm, as illustrated. The disk bears marks which show where contact should be made or broken, and the limits. With a dummy contact breaker on the appliance the cam will break the circuit to the lamp *A* and thus shut off the light at the break position. Cams are ground from a former on an oscillating mandrel, the master cam being six times the size of the cam required.

The finest limit employed in the shops is 0.0003 in. The limits are however usually set down in millimeters, although this is not necesesarily known to the operator, who works to a fixed limit gage.

The permanent magnets are of hardened tungsten steel and as supplied by the Sheffield manufacturers have the pole faces and edges ground after hardening, the limits for the distance between the pole faces being plus and minus 0.2 mm., and for width of holes, plus and minus 0.15 mm. The highest magnetic quality in the materials is necessary because the electrical efficiency of a magneto is greatly dependent on the armature-core flux that is produced under working conditions, the spark energy being in fact proportional to the square of this flux. After no little research, elaborate methods for quickly testing the magnetic quality of each magnet have been developed. The instrument used for this purpose is of the moving-coil type from which the ordinary form of permanent magnet has been removed. Special soft-iron pole pieces are fitted, the instrument being designed so that the magnet being tested can be quickly fitted to these poles. A coil is placed above each pole and when the magnet is in position on the instrument each limb is surrounded by a winding through which current can be passed.

In testing, each magnet is first magnetized by coils on a block of soft iron so arranged that when it is placed on the block the coils embrace the limbs. The circuit through the coils is then closed by means of a switch two or three times, thus effectively magnetizing the magnet. A constant current is maintained through the moving coil of the instrument, with the result that when the magnet is fitted to its soft-iron poles, the instrument reading is directly proportional to the flux produced by the magnet in the air gaps in which the moving coil rotates.

This testing instrument has been devised to enable three determinations to be made on each magnet:

(1) The remanence, this being the flux density remaining in the magnet after magnetizing with a force of not less than 400 g.g.s. units. The term "remanence" really only applies to the condition where the ends of the magnets are closed on themselves, this condition being approximately filled by bridging the poles with a heavy soft-iron keeper.

(2) The coercive force; this is, the demagnetising force necessary to reduce the flux density in the body of the magnet to zero.

(3) An intermediate point on the B-H (flux density and magnetizing force) curve connecting remanence and coercive force so as to obtain some indication of the shape of the curve, it now being recognized that this factor is of vital importance in judging the quality of a magnet.

Generally speaking, if the coercive force is not less than 55, and the remanence not less than about 10,000, the magnet will yield satisfactory results on a magneto. But the view is that misleading results may be obtained if reliance is placed entirely on the coercive force and remanence figures, because it is possible for these figures to be attained in a magnet of poor quality, owing to the fact that the shape of the curve is bad. It is for this reason that the British Thomson-Houston Co. has for some time checked the shape of the B-H curve referred to under (3), by applying a partial demagnetising force, corresponding to an H (magnetizing force) of about 35, and determining the instrument reading under these conditions. When comparing magnets of similar design and make, the instrument reading so obtained is a criterion of magnetic quality.

All magnetos are tested by an endurance run and

FIG. 8. TESTING INSULATION OF MOLDED PARTS

also checked for low-speed sparking separately. For the endurance run, the magneto is slipped into a set position on the bench, eight magnetos arranged in line being driven by means of one horizontal belt. Then each magneto is run for half a minute on its safety spark gap to test the insulation of all parts.

Standard tests of aircraft magnetos are 16 in all. First, the machine is magnetized and then run for half a minute with the secondary winding short-circuited in order to introduce a large demagnetizing force and thus artificially age the magnet. The minimum sparking speed is then determined across a standard spark gap of 5.5 mm. in length. A three-point sparking system is used with nickel points. With the gap named the peak voltage corresponding is about 8000. The limiting speed for low-speed test is 115 r.p.m. with the timing lever fully advanced and 230 r.p.m. for the fully retarded position. Next, the magneto goes to the benches for an endurance test of 12 hr., running at 2200 r.p.m. for an 8-cylinder magneto and 3300 r.p.m. for a 12-cylinder machine, with a spark gap as before of 5.5 mm. length. The magneto then goes back to the assembly shop, is taken to pieces, cleaned and examined, the parts being reassembled. Then the final run of 4 hr. is made at the previous speeds; gap and low-speed sparking tests are applied, after which it passes to the government inspection department. In view of the potential differences involved, considerable care has to be taken in the copper winding on the armature and in the insulation of the various layers forming it. The primary (0.7-mm. diameter) is wound first, in either three or four layers according to type. Between these, varnished Japanese silk 4 mils. thick (0.001 in.) is placed and between the secondary layers either varnished paper 3 mils. thick or silk is placed. Thus, over the second layer of wire may be placed varnished paper and over the third layer silk.

The paper is arranged just to fit between flanges, but the silk is cut wide by, say, 4 mm. so as to overlap about 2 mm. on each side. In this way the armature is divided into a number of separate sections, each with a silk casing all around. To prevent successive layers arcing to one another, it is usual to give a clearance of 3 to 4 mm. at the edge of every layer and also to add varnish by a brush on this spare area. An airplane magneto may have on the secondary 10,000 turns of 0.0044-in. wire, having a length of nearly 1 mile. For an automobile magneto it would have, say 8,000 turns of 0.0036-in. enamelled wire having a ¾-mile length.

The winding machines illustrated in Figs. 6 and 7 are employed, the wire being arranged on spools, with a tension device to give an even pull over the wheel to the spool being wound. The spindle carrying the spool is moved to and fro automatically to suit the layers. After the armature is wound the side pieces of silk are bound over each other and then covered with silk tape and Egyptian cotton. Before varnishing, the armature is placed in a vacuum oven for 4 hr. at 200 deg. F. A coat of varnish being given by a brush, it is then placed in a baking oven for 5 hr. at 200 deg. F. Second, third and fourth coats are then applied and baked giving a total of four bakings.

In testing for insulation of the armatures the primaries are placed in series of three at a time with a battery and contact breaker and operated by an induction motor. The armature is used as an induction coil, the secondary being connected to a standard sparking gap of 7.5 mm. length, this being maintained for about 15 min. The voltage rises to 11,000. To determine the proportion of turns, the voltage is measured at primary and secondary in an alternating magnetic field.

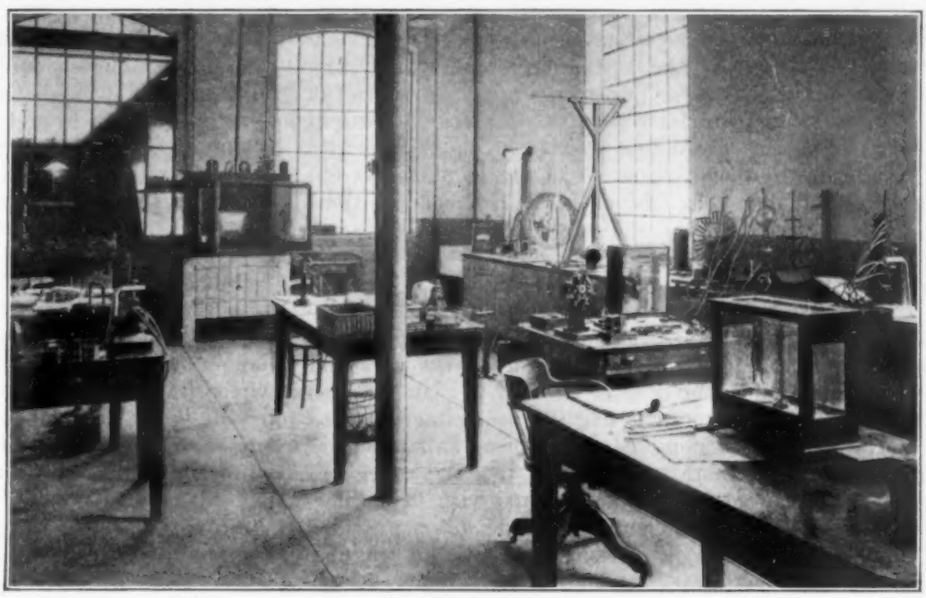


FIG. 9. THE RESEARCH LABORATORY

The condenser is built up of the best ruby mica and tinfoil, a dab of varnish being placed between the two which are then clipped together and baked at 200 deg. F. The varnish squeezes out, spreading so as to make a solid compact mass. The capacity of the condenser for the airplane magneto is 0.16 microfarad and for an automobile magneto, 0.12 microfarad. To test the insulation an alternating current voltage is applied by a step-up transformer, the voltage having a root-mean-square value of about 600. To test for capacity the condenser is charged from Leclanché cells and discharged through a ballistic galvanometer, the throw of the galvanometer being a measure of the capacity.

The test employed to determine the insulation soundness of molded insulation is, to put it briefly, that of a dead short which cuts out a spark on an induction coil. For this purpose, Fig. 8, a standard induction coil is employed, the needle-point electrodes being set to give a ½-in. gap corresponding to, say, 14,000 volts. The detail to be tested is then placed in a frame, which stands on a brass plate connected to one side of the coil. The other side is connected by flexible wire to an insulated needle held by the operator. A dead short, that is an insulation breakdown, is shown by the cutting out of the spark. The frame for the part tested corresponds to the part on the actual machine.

In connection with the work a special investigation department has been equipped for dealing with defects. This department is purposely kept away from the ordi-

nary production side of the organization so as not to disturb the run of the shops. There is an experimental department where new models are built up, special mixings for insulation materials are made, etc.; a research laboratory has been equipped, a section of which is shown in Fig. 9. Here, for example, the resistance of insulating materials to the softening effect of increase of temperature is determined. The material is placed in an oil bath where a weighted plunger, the end tapered to ¼-in. diameter, bears on it. Contacts are set to a gap of 0.002 in. and the temperature of the oil bath is raised until, as a result of the pressure of the weighted plunger, the contacts meet and ring a bell. This is regarded as the softening temperature. The comparison is of course quite arbitrary but is useful.

The German material Stabalite was largely used in Great Britain as a molding insulation material before the war, but during the period of the conflict was obviously not available. Several English compositions have been prepared, and the one adopted has the same softening temperature—namely, 85 deg. C.—that of ebonite, for comparison, being 45 deg. to 50 deg. C. Other work carried out here is determining the hysteresis curves of magnetic materials. A rotary spark gap will be seen, the characteristic of the sparks given off by the magneto being discovered, and the lag between the opening of the contacts and the beginning of spark ascertained. This amounts to only about half a degree, at 3,000 r.p.m. In this laboratory, too, the energy of spark is measured by the temperature rise in a calorimeter, and further, a complete equipment is provided for measuring the peak voltages met with in magneto work. This comprises a kenetron valve and electrostatic voltmeter. A number of spark plugs have been tested, the results suggesting that, in the past at any rate, these articles have not been of anything like standardized quality, as regards the voltage required to produce a spark.

The Trials of Old Baldy—I

By A. R. Durant

The Ajax Machine Co. during its long and troubled existence has had many queer characters upon its payroll, because of its custom of hiring tramp machinists and other floaters whenever opportunity afforded or business necessitated. Some of these would last a week while some would make their stay more brief, but while they lasted each was pretty certain to cause more or less trouble for "Old Baldy," the foreman.

Old Baldy was some peculiar himself. As "Deek" Williams used to say, he was "intensely independent and considerable sarcastic," and when, in the persons of Old Baldy and some of the above characters, Greek met Greek, there was something started besides a restaurant. Thus after awhile the old standby's began to dub the new-comers as "Old Baldy's Trials."

One morning a man blew in with a little imitation-leather tool case in his hand and a long black dust coat over his arm. He was an "expert" lathe hand, who had "worked in all of the big shops in the country."

Old Baldy put him on, and when he had got ready for business "Slim" Benson was overheard to remark that he "thought the new guy was a horse doctor when he came in, but now he looked more like a sick priest."

Baldy gave the man a light cast gear about 10 in. in diameter, and explained that the hub was to be faced off and the bore threaded to fit a shaft which was already lying on the bench waiting for the gear to be fitted to it, "and it wants to run pretty blame true," he appended.

The reverend-looking gentleman managed after much endeavor to get the gear in the chuck and trued up fairly well, and, after a great deal of tool grinding and setting, to face off the hub and rim. Then putting a dog on twist drill and supporting the latter by the tail center he proceeded to stab a hole through the hub of the gear. Though the drill wabbled a good deal he got the hole through without its snagging and jumping of the tail center, which was disappointing to the furtive watchers. He next got the tap of the right diameter and pitch and wrung it through the hole with a monkey wrench without any preliminary boring or threading.

Releasing the gear from the chuck he screwed it onto the threaded shaft and put the assembled piece on centers to test its truth. Old Baldy had a habit of happening around at the psychological moment, so when the parson started up the gear Baldy was just behind him. At the first movement Baldy yelled to one of the old hands: "Fer Gawd's sake Bill, shet that winder. Ef this here job ever gits out of the shop we never'll catch it again."

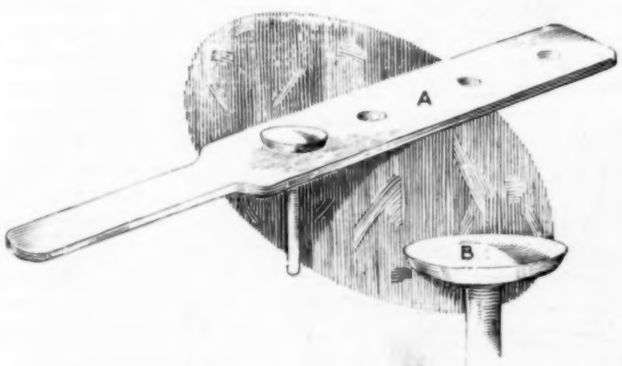
After the excitment had abated, Old Baldy carefully explained to the new man that he was altogether too heavy for the light work demanded by the Ajax Co. and so the parson faded sorrowfully away.

A Handy Tappet Valve Holder

By Hugh Scott

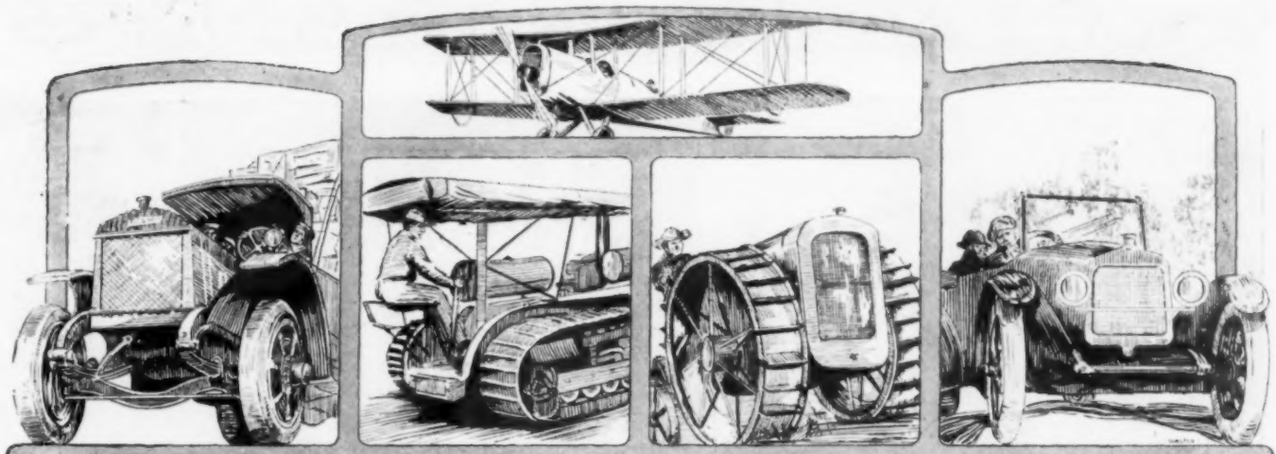
At the plant of the Willys-Overland Company, West Toronto, they use a handy holder for heat-treating their tappets which is well worth explaining.

Referring to sketch we see at *A* what the holder looks like, while *B* shows the tappet itself. These tappets are hardened in a lead bath and several holders are used.



HOLDER FOR HEATING TAPPETS

As soon as the tappets reach the proper heat the holder is removed, right side up, and lifted over to the oil bath, where by merely turning the holder over, the four pieces fall out into the oil. It is but a matter of a moment to drop four fresh pieces into the holder, and continue the procedure.



AUTOMOTIVE CONSTRUCTION

Pistons for the Fordson Tractor

BY FRED H. COLVIN
Editor, *American Machinist*

Those who have the idea that the building of motors for use in tractors does not require the same care as motors in faster-moving vehicles, must revise their opinion. For while the vehicle itself moves at slow speed, the motor is running at its normal, if not its maximum load, almost continuously. This article shows how the pistons are made for such a motor.

THE transformation sheet in Fig. 1 gives a good general idea of the way in which the main operations on the Fordson piston are performed. It also shows the general design of the piston and the way in which it is held during the different operations. The first operation is to mount the piston casting on an expanding mandrel, as in Fig. 2, to face both ends and at the same time bore the inside of the skirt to be used as a locating point in future operations. This is done on a turret machine with a cross-slide, the boring being accomplished by a short, rigid tool in the slot *A* at the end of the tool block, which is readily adjusted by means of the screw *B* to maintain the correct size. Next comes the rough-drilling of the piston-pin hole in a New Britain double-deck chucking machine, Fig. 3. The piston is located by the bore of the skirt and also by the piston-pin bosses to insure the holes coming in the right position. The pad *A* fits inside the piston and forces it against a suitable seat at *B*. The illustration shows a loading station, the holes being drilled in the usual manner. This machine handles

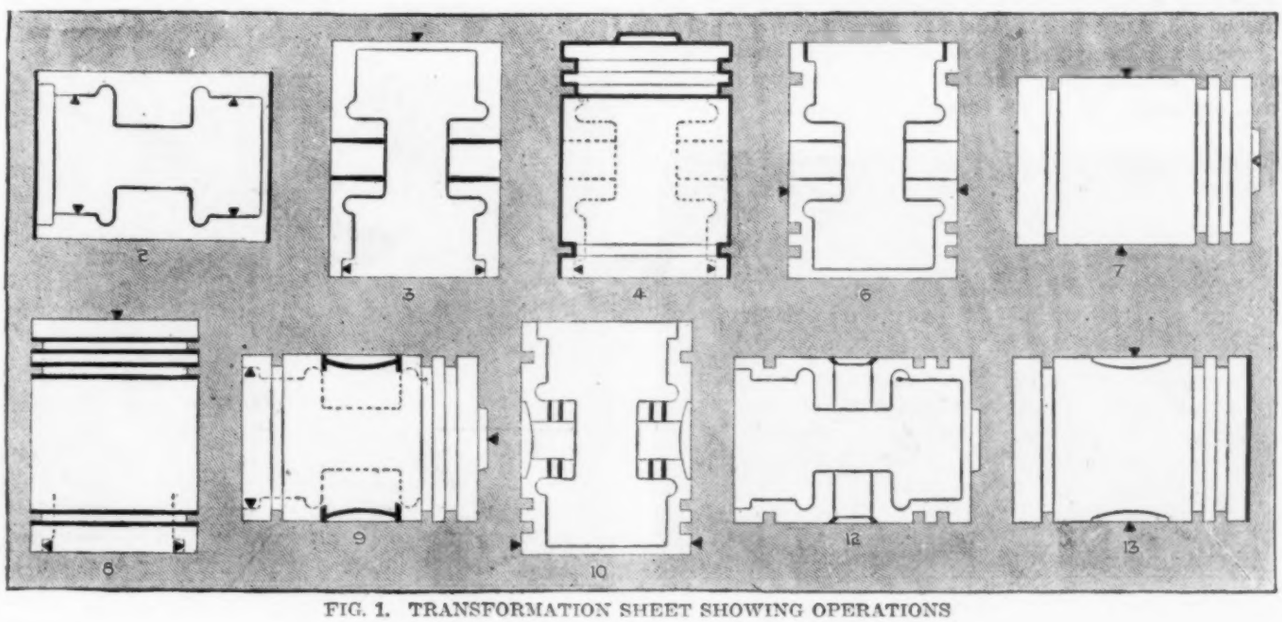


FIG. 1. TRANSFORMATION SHEET SHOWING OPERATIONS

AUTOMOTIVE CONSTRUCTION

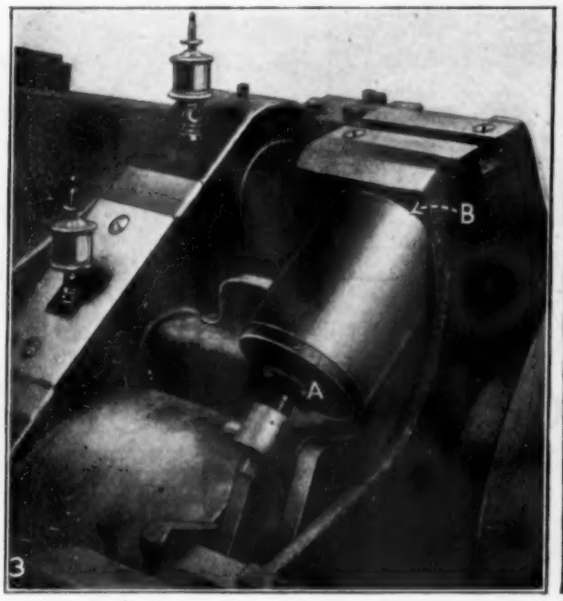


FIG. 3. DRILLING PISTON-PIN HOLES

FIG. 4. ROUGH TURNING AND GROOVING

a little over 300 pistons in eight hours. Using the open end of the skirt for location and the piston-pin hole as a means of clamping the piston rigidly in position, the rough-turning and grooving is done on a special Foote-Burt machine, as shown in Fig. 4. The turning tool is held in the block *A*, the facing tool for the top is at *B*, and the grooving tools are held in the tool block *C*. Stellite is used for this operation and has been found very satisfactory. The rough-turned piston is shown at *D*, and the pin which holds it in position for turning can be seen at *E*.

Annealing to Relieve Stress

To relieve internal and other stresses which may have been imposed by the previous machining operation, the pistons are annealed in the continuous furnace shown in Fig. 5. They are delivered to the end of the furnace nearest the reader by the inclined runway shown, and after passing through are placed on a similar runway at the other end, by which they pass easily and automatically to the following operation.

To insure all future operations being accurate and within the prescribed limits, the open end of the skirt is next reamed, as shown in Fig. 6, particular attention being paid to keep this diameter within a total variation of 0.002 in. Here the piston is held without distortion between the blocks *A* and *B*, the cam *C* forming a clamp which operates quickly. The gage is shown at *D*.

Centering and Relieving

Holding the piston in the split or contracting chuck shown in Fig. 7, the end is carefully centered as an aid in securing accuracy in all future operations. One of the first uses of this center is shown in Fig. 8, where the grooves are being finished to size by the tools in the special tool block shown. This operation also finish-turns the pistons to size, after which the sides are relieved over the piston-pin bosses as shown in Fig. 9. This is for the purpose of retaining oil at this point

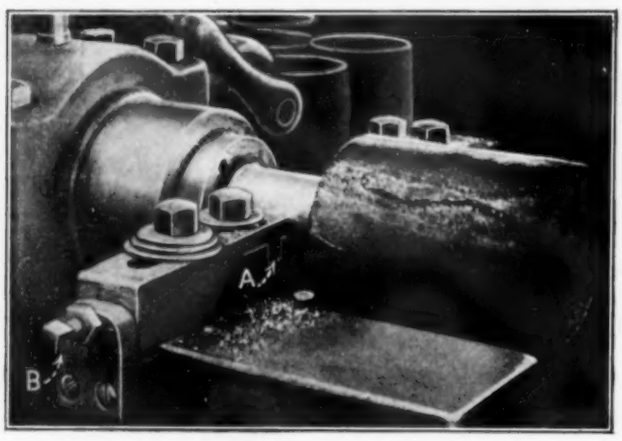


FIG. 2. FACING AND BORING OPEN END OF PISTON

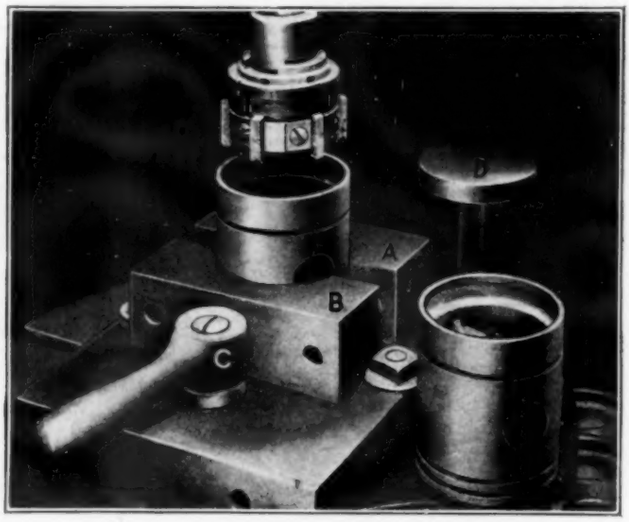


FIG. 6. FINISH-REAMING PISTON SKIRT

AUTOMOTIVE CONSTRUCTION

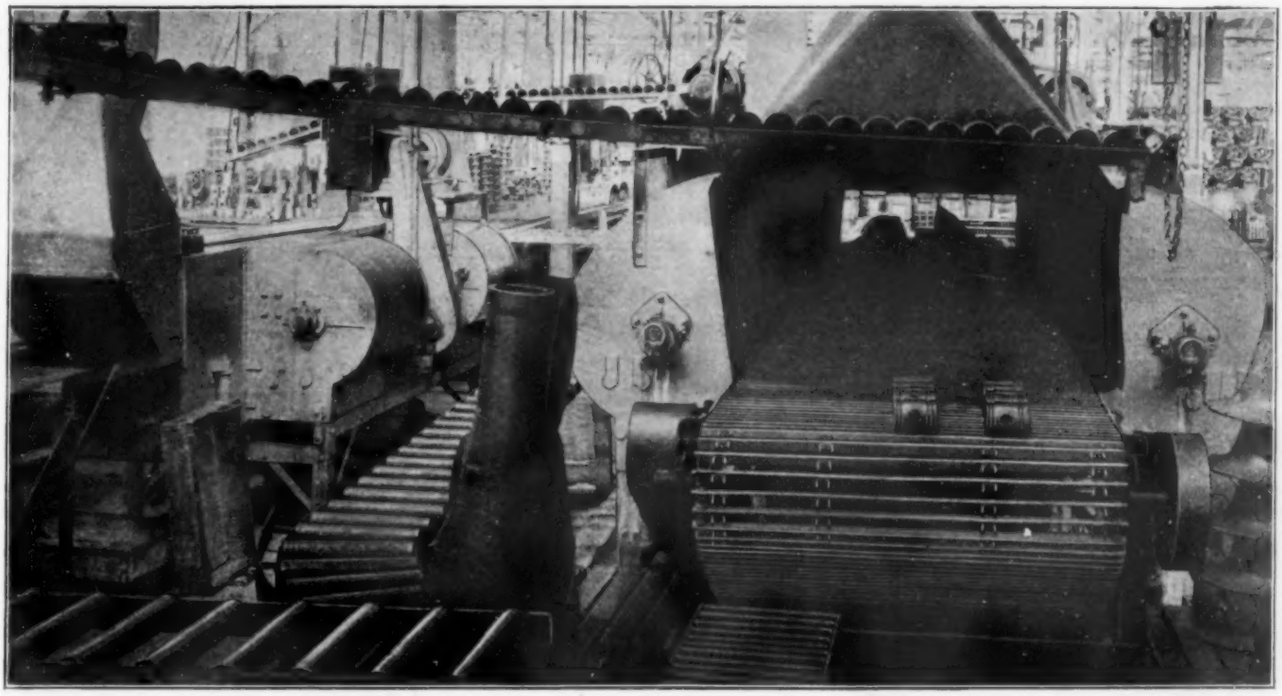


FIG. 5. ANNEALING PISTONS IN CONTINUOUS FURNACE

for aiding in the lubrication of the piston pin and it also allows for extra expansion of the piston at this point.

The clearance or relief is cut in a somewhat similar manner as the relieving or backing off of cutters in the toolroom. The tool *A* held in the block *B* cuts the full width of the relief. Its action is controlled by the roller *C*, acting on the cam *D*, this cam allowing a heavy spring to feed the cutter into its work at the proper point and forcing it out as soon as the piston has turned past the piston-pin hole. The piston is held on a mandrel, the outer end being supported by the substantial collar *E* and driven by the pin *F*. The pistons are handled very rapidly in these machines.

The oil holes through the piston-pin bosses are drilled in the simple fixture shown in Fig. 10. The lugs *A*, *B*, and *C* locate the head end of the piston, while the bushing plate *D*, which is located from the piston-pin hole, carries two bushings and allows both holes to be easily drilled by simply turning the piston in the fixture. This enables the pistons to be handled very rapidly, the production being astonishingly high on this operation.

Finishing the Piston-Pin Hole

Next comes the finish-reaming and chamfering of the piston-pin hole, these operations being shown in Figs. 11 and 12. The piston is held in a very simple fixture for the reaming operation, expanding reamers being used for this purpose. The plug gage is shown at *A*, Fig. 11. The chamfering is done by simply laying the piston in a semi-circular block and using a shell taper reamer as shown in Fig. 12. The burrs are then taken off by hand with an 8-in. mill file, after which the end of the piston is finished in what might be called a shaving operation. This is shown in Fig. 13, the tool at *A*

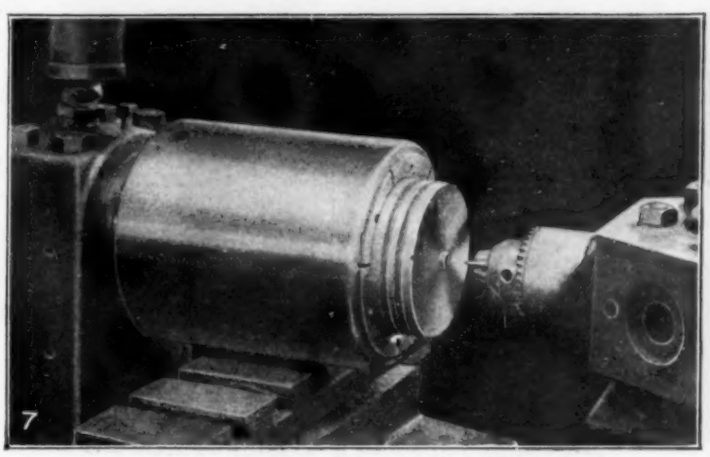


FIG. 7. CENTERING HEAD OF PISTON

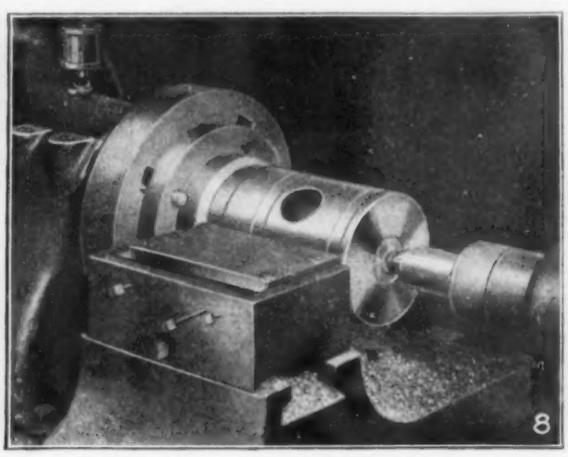


FIG. 8. FINISH-TURNING AND GROOVING

AUTOMOTIVE CONSTRUCTION

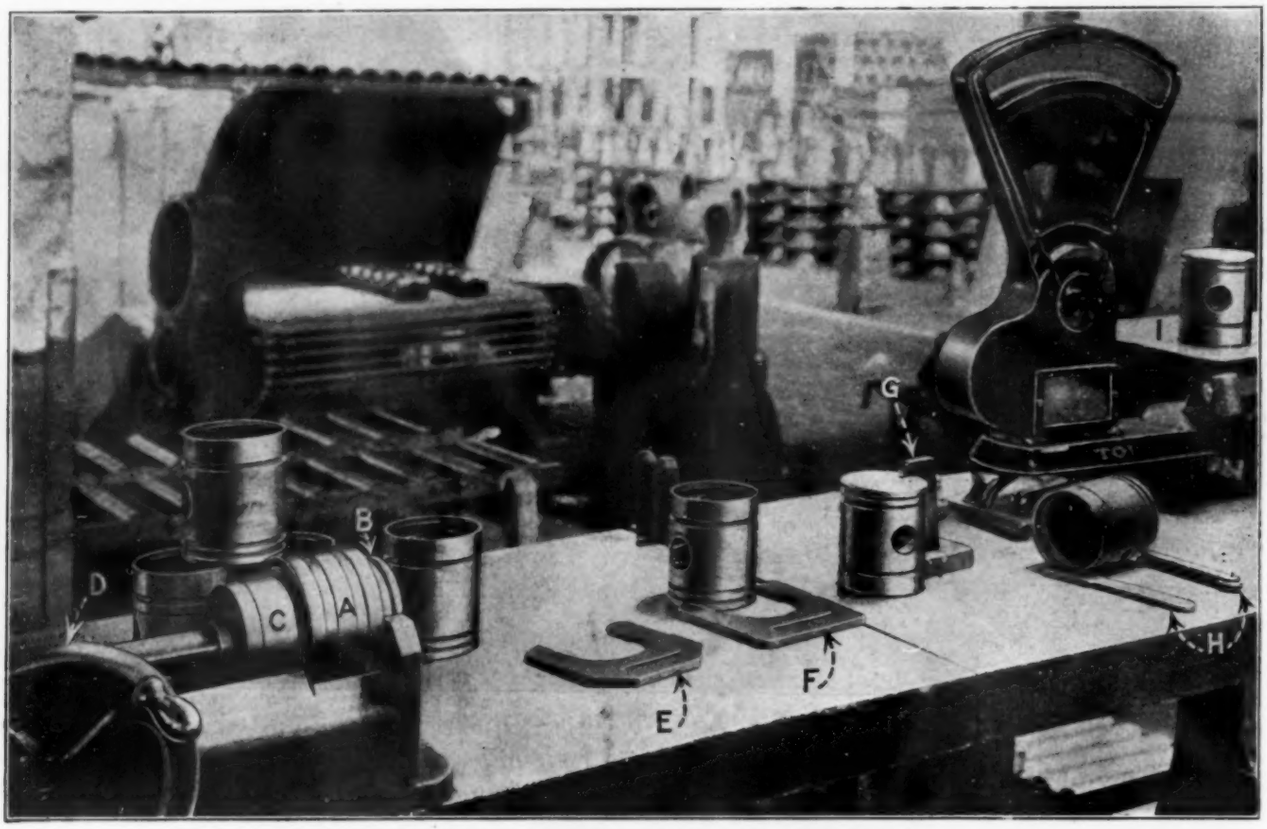
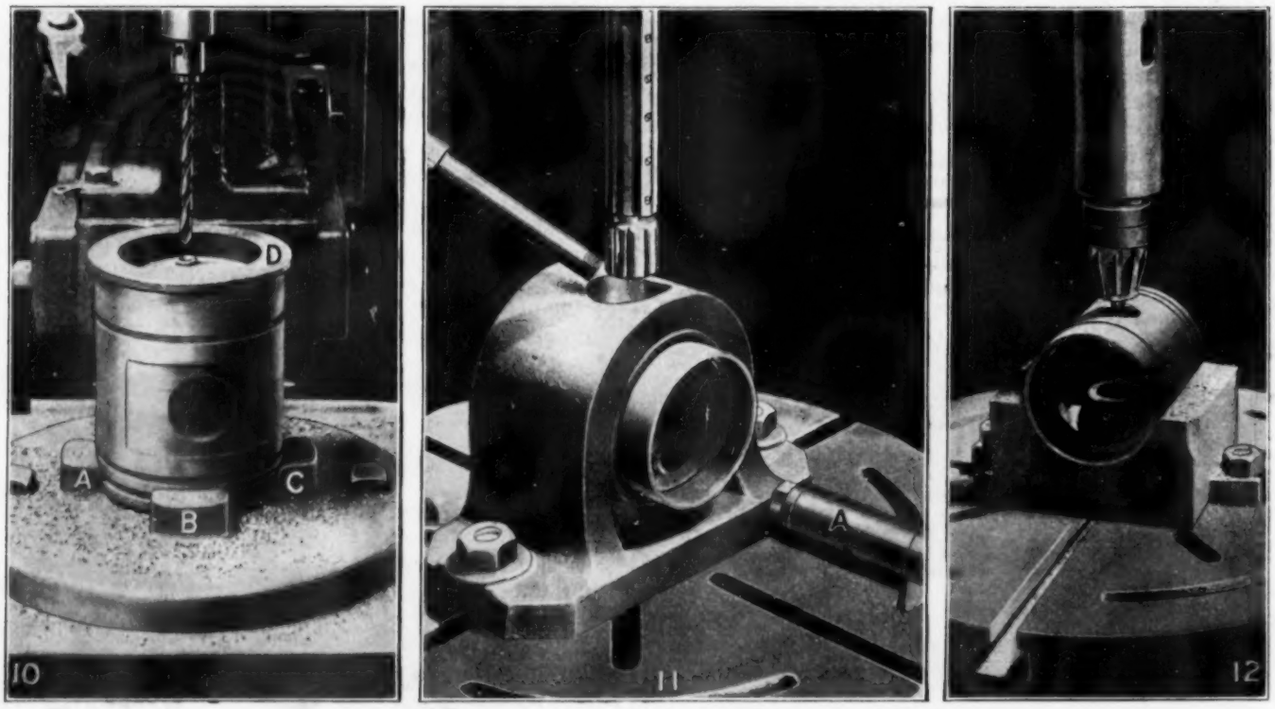


FIG. 14. BENCH AND GAGES FOR FINAL INSPECTION



FIGS. 10 TO 12. DRILLING AND REAMING OPERATIONS

Fig. 10—Drilling Oil Holes in Piston-Pin Bosses. Fig. 11—Finish Reaming Piston-Pin Hole. Fig. 12—Chamfering Piston-Pin Hole

being rigidly supported. Over 30 pistons per hour are done on each machine.

The pistons are then thoroughly washed to remove all chips, after which they are ready for the inspector's bench shown in Fig. 14. Coming in from the left they are first tested for diameter in the gage *A*, which is

AUTOMOTIVE CONSTRUCTION

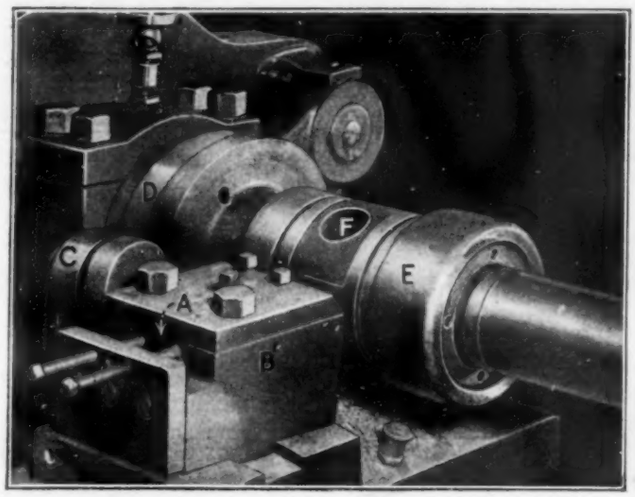


FIG. 9. CUTTING RELIEF ON SIDE OF PISTON

mounted in the hand machine shown. The piston *B* is being pushed through the gage by the plunger *C*, this being operated by the handwheel *D*. The way in which it passes this gage determines its size, the total variation being from 3.995 to 3.997 in., this giving the proper clearance in a 4-in. cylinder. Should a piston be so large as not to go through the gage easily, the ring *A*, with the piston inside, is lifted out and reversed, the plunger *C* pushing the piston back out of the gage without difficulty.

The gages *E* and *F* determine the depth of the piston grooves, gage *G* the proper length of the piston, and gages *H* the width of the grooves at each end. These are held between 0.25 and 0.251 in. in each case.

Head End of Piston Reduced

The head end of the piston, as far back as the land between the two head rings, is reduced to 3.984 to 3.987

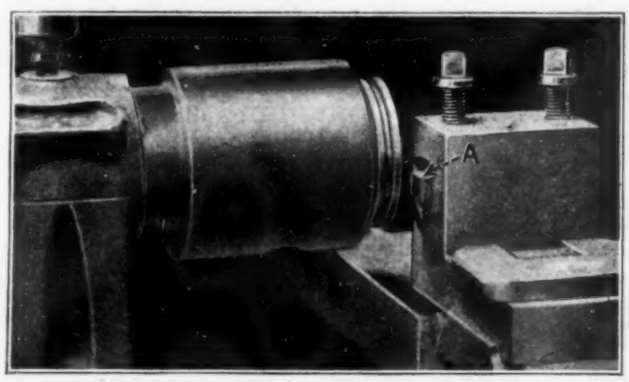


FIG. 13. FINISHING HEAD OF PISTON

in. to allow for expansion due to the extra metal and to this part of the piston receiving the greatest amount of heat. The pistons are then carefully weighed at *I* and asserted into sets of equal weight, the variation in each set being limited to within ½ oz. As with the other Ford practice, no grinding is allowed in finishing the pistons, the contention being that the surface of the metal as it comes from the tools is most suitable for the work.

Some Interesting Piston Operations

By Frank C. Hudson

The following operations from the shop of the Peerless Motor Car Co. have been selected on account of their peculiar interest and not with a view of showing the entire process of manufacture. Most of the remaining operations are standard practice in well-known

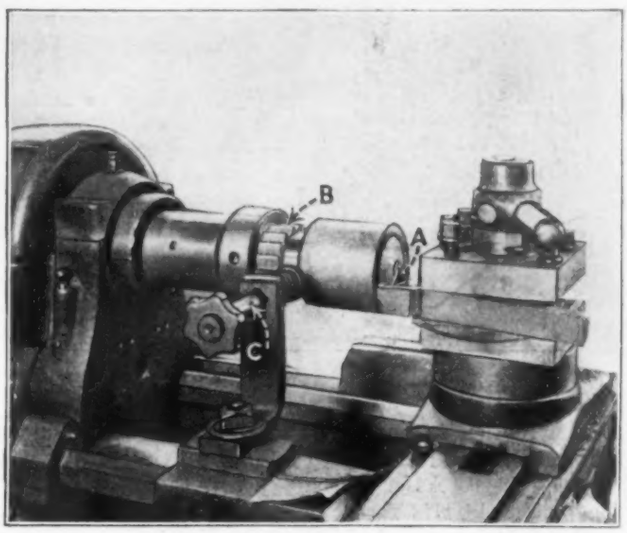


FIG. 1. FACING, BORING AND REAMING OPEN END OF PISTON

shops where the output is not, and cannot be, extremely large on account of the character of the car built.

In selecting these operations the main object is to show the ingenious and practical manner in which the problem of producing a limited number of pistons at an economical cost has been solved. The piston department is arranged in a very compact form so as to avoid

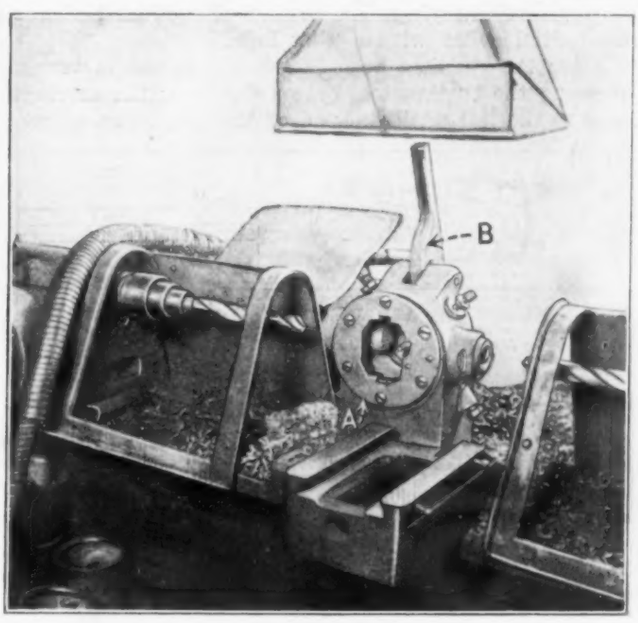


FIG. 2. DRILLING PISTON-PIN HOLES

AUTOMOTIVE CONSTRUCTION

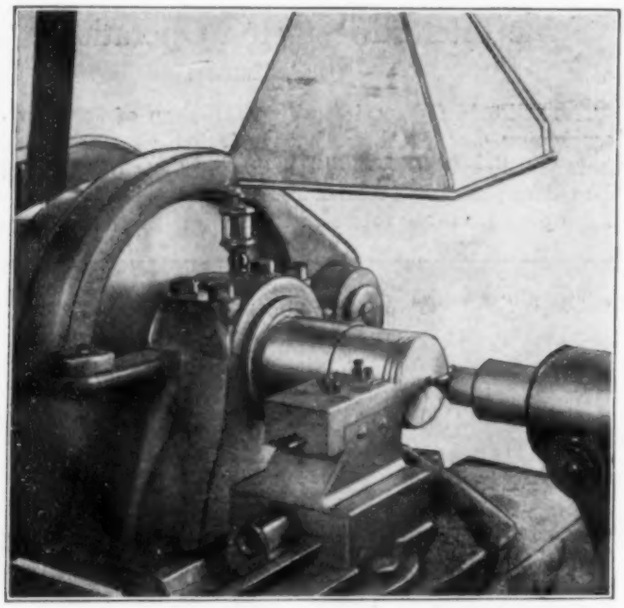


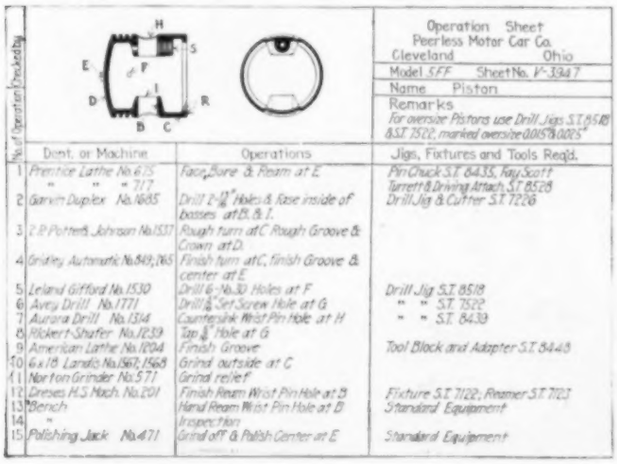
FIG. 3. FINISH-TURNING PISTON-RING GROOVES

all lost motion in handling and to insure a continuous flow of the product from one end of the department to the other. As a starting point, the open end of the piston skirt is faced, bored and reamed by means of the ingenious method shown in Fig. 1.

Piston Held on Expanding Mandrel

The piston is held on a special expanding mandrel which centers it and holds it firmly in spite of the overhang shown. The tool *A*, shown in the front of the tool block, bores and faces the open end of the pistons, being swung 90 deg. by the turret toolpost for that purpose. It is turned in the position shown in order to obtain a clear view. Then the ingenious reaming device shown at *B* is brought into play. This consists of a sleeve carrying the reamer shown, and also a substantial collar with a pilot hole.

After the end has been bored, the turret is turned to swing the cutting tool out of the way; the carriage runs to the left until the end of the pin *C* can engage



Operation Sheet
Peerless Motor Car Co.
Cleveland Ohio
Model SFF Sheet No. V-3347
Name Piston
Remarks
For oversize Pistons use Drill Jigs S.T. 8518 & S.T. 7522, marked oversize 0.005" & 0.007"

No. of Operation	Dept. or Machine	Operations	Jigs, Fixtures and Tools Reqd.
1	Prentice Lathe No. 6 & 7	Face, Bore & Ream at E	Pin Chuck S.T. 8435, Fay Scott Turrett & Driving Attach. S.T. 8528
2	Garvin Duplex No. 1665	Drill 2-$\frac{1}{8}$" Holes & Rase inside of bosses at B & F	Drill Jig & Cutter S.T. 7228
3	C.P. Potter & Johnson No. 1537	Rough turn at C Rough Groove & Crown at D	
4	Gridley Automatic No. 849, 1765	Finish turn at C, finish Groove & center at E	
5	Leland Gifford No. 1530	Drill 6-No. 30 Holes at F	Drill Jig S.T. 8518
6	Avey Drill No. 1771	Drill & Set Screw Hole at G	" " S.T. 7522
7	Aurora Drill No. 1314	Countersink Wrist Pin hole at H	" " S.T. 8439
8	Rickert-Shafer No. 1239	Tap $\frac{1}{8}$" Hole at G	
9	American Lathe No. 1204	Finish Groove	Tool Block and Adapter S.T. 8448
10	6 x 18 Landis No. 1567, 1568	Grind outside at C	
11	Norton Grinder No. 571	Grind relief	
12	Dreses H.S. Mach. No. 201	Finish Ream Wrist Pin Hole at B	Fixture S.T. 7122; Reamer S.T. 7123
13	Bench	Hand Ream Wrist Pin Hole at B	Standard Equipment
14	"	Inspection	
15	Polishing Jack No. 471	Grind off & Polish Center at E	Standard Equipment

FIG. 4. OPERATION SHEET OF PEERLESS PISTON

the hole in the large collar. This prevents the reamer from turning and also allows it to be fed into the work, effectively sizing the open end of the piston without removing it from the mandrel and insuring the bore being concentric with the inside and at right angles to the end which has been faced.

The piston-pin holes are next drilled in the double-headed machine shown in Fig. 2. The piston is pushed in from the back, centering on a raised concentric projection inside the end plate *A*, and held in position by the cam *B*. It is also located with reference to the pin bosses by suitably inclined surfaces inside the fixture. The inner ends of the bosses are also faced by suitable cutters in this operation.

The pistons are then rough-turned in the regular way on a semi-automatic machine, after which they are finish-turned in the engine lathe shown in Fig. 3. This also finishes the grooves by means of the special tool block shown. Figs. 2 and 3 both show the hood of the exhaust system which removes the loose particles of cast-iron dust that were formerly so annoying to the machinist.

Some Miscellaneous Operations

Following these operations are: the drilling of oil-drainage holes through the piston, drilling the setscrew hole which fastens the piston pin firmly in place, and grinding the outside and also the relief over the piston-pin boss. Then comes the finish-reaming of the wrist-pin hole, after which it is again reamed by hand and the piston carefully inspected. The last operation is to grind off the center projection and polish the piston at this point.

Fig. 4 shows the operation sheet used by the Peerless Motor Car Co. and is given as an excellent example of a simple and compact form of sheet for this purpose. The illustration of the piece itself together with the reference letters showing exactly what is referred to in each operation, makes it easy to follow the work from point to point and is very helpful to the department head as well as to the men who are really interested in the work.

Tapping Aluminum Castings

By T. Greening

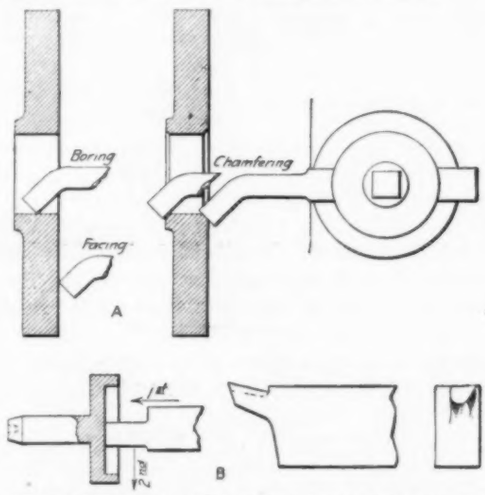
Tapping holes in aluminum castings sometimes becomes a troublesome job owing to the ease with which the holes are reamed or the threads are stripped before the tap gets to work properly. We had trouble when using a jig for drilling and facing crankcase side-hole covers.

After the tapping hole had been drilled, the drill bush was removed to allow of countersinking and facing, after which the piece was tapped. In this operation a good many pieces were spoiled by the tap either reaming or stripping the first two or three threads. To obviate this trouble a screwed guide bush was made and used with perfect success. It insures the tap leading into the work properly and the employment of such screwed bushes in jigs for crankcases, gear boxes, etc., has entirely eliminated the scrap previously due to badly tapped holes.

Saving Time Between Cuts

BY CHARLES CANEC

There are times when it is an economy to use two tools at once, and there are other times when a saving can be effected by using the same tool for two or more operations. Even when the form of tool used necessitates a reduction in cutting speed, the time saved between cuts may more than compensate for this loss, as the machinist does not need to waste time changing tools, etc. The sketch shows at *A* the boring and facing of a flange, all the work being done with one tool. At *B* is shown the recessing of a "piercing nose" for a cartridge die. In the latter case the carriage is locked and the compound rest turned at right angles to the crossfeed so that the depth of recess, 0.125 in., can be gaged by the micrometer collar on the compound screw.



USING THE SAME TOOL FOR MORE THAN ONE OPERATION

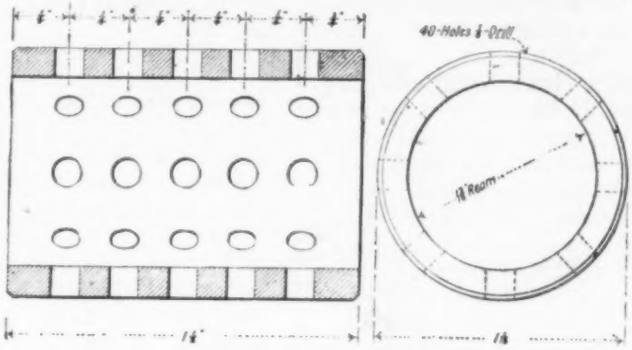
These are two simple illustrations of what can be done to save time when doing repetition work on the engine lathe, and in the small shop where chucking machines and turret lathes are scarce, little wrinkles of this sort help to increase production.

Rotary Bushings

BY ROBERT MAWSON

Regarding the various articles which have lately appeared in the *American Machinist* on rotary bushings and their use and methods of manufacture, I herewith send you a sketch of a type that has been found very satisfactory on high-grade textile machinery.

Bushings of this type are used on medium-speed work, say up to about 350 r.p.m. The bushings are made of cast iron with the inside reamed to be a good fit on the shaft and the outside diameter turned to a running fit in the bearing housing. Forty $\frac{1}{8}$-in. holes are drilled



A ROTARY BUSHING

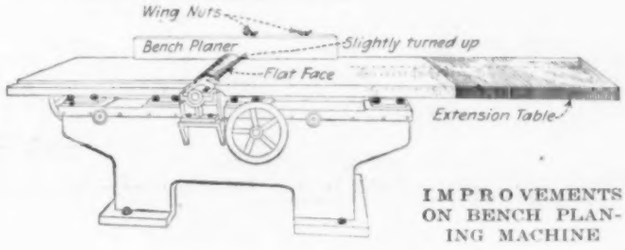
as shown. The holes are filled with graphite and heavy oil, and we have had some bearings in service for about five years without showing appreciable wear.

Improving a Bench Planing Machine

BY M. E. DUGGAN

In my bench planing machine I have made a few changes that might interest the makers of these machines: The first is a 12-in. extension to the front table. With his extension I can dress light but much longer stock than could be dressed on the short table. Next, I have discarded the regular nut for clamping the gage and substituted wing nuts. Where frequent adjustments are necessary a wrench becomes a nuisance.

The front edge of the guard being very thin, the stock to be planed has a tendency to ride over instead of pushing the guard open especially if the corner of the stock is slightly rounding. To correct this trouble I have turned the front edge up to form a vertical face for the stock to press against.



IMPROVEMENTS ON BENCH PLANING MACHINE

War on the Decimal System

by

Frederick Franz, M.E.

We are presenting here two independent efforts to provide a substitute for our present decimal system as applied to measurements in the shop. They were apparently conceived about the same time, although neither was written up until some time later. It is hoped that constructive criticism will be provoked and the comments will be based on careful study of both articles. Perhaps this idea may lead to the discarding of the awkward common fractions and decimal equivalents—Who knows?

The Octimal System of Numerals

LET us look into some of the elements in the measurement of magnitudes. When dividing any magnitude, as *AB*, Fig. 1, into smaller units for the purpose of measurement, the first national division that suggests itself is to halve it as at *C* so that any other magnitude *XY* could be measured by the number of units *AC* contained in it. If these subdivisions proved too coarse, commonsense and human instinct always moved us to again divide them into two as at *D* and so on as at *E* until we obtained the degree of minuteness and precision sought.

This spontaneous division into halves is due to the ease of physically or mentally dividing the magnitude into two parts and to the ease of comparing the accuracy of the division. A division into more than two equal parts, although just as possible as division into two parts, makes the process physically more difficult, taxes the mind to a greater degree, and makes a comparison of the accuracy of the division more difficult. A notable example of the spontaneous tendency is afforded in the report of Frederick A. Halsey on "The Weights and Measures of Latin-America," Journal A. S. M. E., November, 1918, page 947. We find by examining this report that in Brazil, although the metric system is in use, ½ and ½ kilograms are used in place of grams or decigrams.

Referring again to Fig. 1, after dividing at *C* into two, only one sensible factor could possibly influence a further division into fifths in preference to halves, thirds, quarters, sevenths, or any other division. This factor is our concept, that, if we applied the consecutive numbers of our present number system (0-9) to the consecutive divisions we would effect the desirable condition of having our magnitude jump to the next higher (or lower) order simultaneously with our numerals, thus making easy the numerical conversion of units from higher to lower orders or vice versa. This is the justified basis of the creation of the ten-unit division of magnitudes under the metric system.

But the binary subdivision has been carried out whenever no regard was given to our present system of pure numbers. Thus, we see that in the manufacture of most products of such size that the inch alone may be used without resorting to larger units, binary division (halves, eighths, sixty-fourths, etc., of an inch) has survived as the fittest division, excluding those cases where free adoption has been hampered by compulsory legislation. Institute decimal division; yet binary thought will continue just the same. Ten cents equal one dime; ten dimes equal one dollar (a decimal system), but a fifty-cent piece equals one-half dollar, and a twenty-five-cent piece equals one-quarter dollar, and in some sections of the country "two shillings," by common though corrupt usage, has grown to mean twenty-five cents; that is, one "shilling" equals one-eighth dollar. Also, a nickel equals one-half dime.

Where is the fault? Someone once suggested that if man had only eight fingers instead of ten, our number system would have been started correctly. Just so. During the writer's strife in handling a vast number of dimensions in figures of thirty-seconds and sixty-fourths

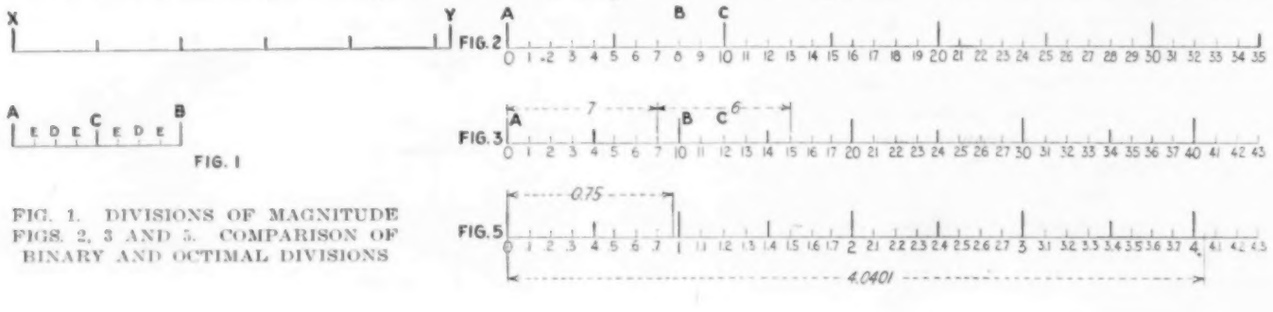


FIG. 1. DIVISIONS OF MAGNITUDE
FIGS. 2, 3 AND 5. COMPARISON OF BINARY AND OCTIMAL DIVISIONS

of an inch in the redesign of a machine several years ago, he evolved the following octimal system of numerals. Let us construct this system and see how easy the representation, addition, substraction, division, etc., of

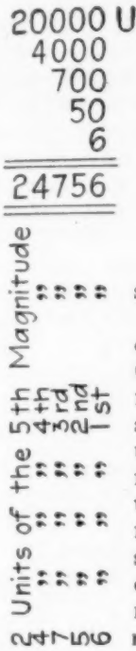


FIG. 4. COMPOSITION OF AN OCTIMAL NUMBER

such figures as $\frac{1}{8}$, $\frac{1}{8^1}$, $\frac{3}{8^2}$, etc., become.

In Fig. 2 let us call the spaces 0-1, 1-2, etc., units of the first magnitude; spaces 0-10, 10-20, etc., units of the second magnitude, or briefly first magnitude, second magnitude, etc., respectively. Now, under our present decimal system, ten first magnitudes equal one second magnitude, the 0 in the number 10 meaning no first magnitude, and the 1 meaning one second magnitude. Thus 28 indicates eight first magnitudes and two second magnitudes. See also Fig. 4. Now let us refer to Fig. 3: 0-1, 1-2, etc., are still equivalent units of the first magnitude, but instead of changing to the second magnitude at C (Figs. 2 and 3) we will change at B, calling the space (A-B) one second magnitude and assign to it the proper character, 10, Fig. 3, which means one second magnitude and no first magnitude. Now, in the octimal system we must forget entirely that such characters as 8 and 9 ever existed. Also, for convenience in understanding what follows, whenever a number in the decimal system is used it will be underlined, thus: 2, 4, 8; and numbers in the new (octimal) system will be written plain, thus: 2, 4, 10. By comparing the two scales we see that $\underline{2} = 2$, $\underline{7} = 7$, $\underline{10} = 12$, $\underline{17} = 21$, etc.

Fig. 5 represents an enlarged scale of Fig. v; 0-1, 1-2, ect., are equal on both scales. In Fig. 5, 0-1 is divided into 10 (not 10) divisions as shown, numbered .1, .2 . . . .6, .7, 1.0. Each of these equals one-tenth (not one-tenth) of a first magnitude, and is indicated as such by a figure and octimal point as shown. Each one of these may again be subdivided into tenths, but then a cipher must be prefixed, thus: .01, 02, ...06, .07, .1. (In other words, the octimal point must be moved one space to the left.)

With the foregoing principles firmly borne in mind, we are able to perform elementary arithmetical operations. First, we will construct our addition table (see Fig. 6). Should we choose actually to make use of this system we must memorize this table of addition or keep it constantly before us. Each figure inside of the heavy lines at the intersection of a column and a row is the sum of the numbers at the head of its column, and at the right-hand end of its row appearing immediately outside of the heavy lines. Thus: $4 + 3 = 7$, $6 + 5 = 13$, etc. Just as in our old system it was necessary to memorize that $7 + 8 = 15$, so in our new system we must memorize additions and multiplications. Often during our day's work, as we rapidly add, multiply, etc., we fail to realize that we once had to commit to memory the fact that $8 + 9 = 17$ and $7 \times 9 = 63$, etc. The table shows that $7 + 6 = 15$. This figure was obtained by counting 7 units from 0 to 7, see Fig. 3, and then counting 6 more, proceeding from 7 in the same direction and ending on 15. Every other sum given in the table was obtained in a similar manner. The reader is now able to prove the following examples in addition.

23	23	23	43	54
33	34	35	35	66
56	57	60	100	142

By adding in exactly the same fashion as in the decimal system except using the table in Fig. 6 for the sums, we can easily prove these figures. Thus, in the last example, adding the 4 and 6 (by table), we get 12; write 2 and carry 1; 6 and 1 are 7 (by table) and 5 equal 14. A

1	2	3	4	5	6	7	10	0
2	3	4	5	6	7	10	11	1
	4	5	6	7	10	11	12	2
		6	7	10	11	12	13	3
			10	11	12	13	14	4
				12	13	14	15	5
					14	15	16	6
						16	17	7
							20	10

FIG. 6. TABLE OF ADDITION

few examples of the expression of some equivalent fractions in both systems follow:

$\frac{1}{2} = .5 = .4$ $\quad\quad$ $\frac{1}{16} = .0625 = .04$

$\frac{1}{4} = .\underline{25} = .2$ $\quad\quad$ $\frac{1}{8^1} = .\underline{015625} = .01$

Note the simplicity of representing these fractions.

For example in addition of fractions let us take the following:

Decimal addition of: $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{16}$ and $\frac{1}{64}$	Octimal addition of: $\frac{4}{10}$, $\frac{2}{10}$, $\frac{1}{10}$, $\frac{1}{10^2}$, $\frac{1}{10^3}$ (Same values as given in decimal comparison)
.5	.4
.25	.2
.125	.1
.0625	.04
.015625	.01
.953125 = $\frac{61}{64}$ Ans.	.75 Ans.

(The heavy line placed under a figure identifies it as belonging to the decimal system.)

For comparison of the work of addition the two methods are shown together. But the actual work of adding is not the only factor that saves time.

This example, for instance, does not show how in the decimal addition we must first reduce the common fraction to a decimal, then after adding the decimals finally reduce the decimal to a common fraction again before we are able to lay off this value from a scale, if it is in inches. In the octimal system our figures are already in the octimal form. (We can write them as a vulgar fraction, as shown, if we choose). All we need to do is to add them octimally to obtain the answer. We find in this case that the value is .75. This value is in the sub-unit .7 to 1. This sub-unit of .1 of a unit is again divided into 10 (or 8 if you please), 5 of which must be added to the .7. Note that .75 is not midway between .7 and 1. (The median point is .74.) See Fig. 5.

1	2	3	4	5	6	7	10	1
2	4	6	10	12	14	16	20	2
		11	14	17	22	25	30	3
			20	24	30	34	40	4
				31	36	43	50	5
					44	52	60	6
						61	70	7
							100	10

FIG. 7. TABLE OF MULTIPLICATION

The part of this system which produces the most astonishing results for rapid calculation is the multiplication and division of fractions. In Fig. 7 is shown the octimal table of multiplication. This differs from Fig. 6 only in that the figures at the intersection of the column and rows are the octimal products of the numbers at the head of the columns and right end of the rows. Thus, $3 \times 2 = 6$, $4 \times 3 = 14$, $6 = 5 = 36$, $10 \times 10 = 100$.

These products were obtained by taking a number of steps from zero along the scale, Fig. 3, the length of each step being made equal to the multiplicand and the number of steps being made equal to the multiplier, always starting a following step where the previous one ended. Thus, taking 5 as a multiplicand and 1 as a multiplier, we start at zero, add 5 and end at 5, our product. With 2 as a multiplier, we start at 5, add 5 and end at 12, our product. With 3 as a multiplier, we start at 12, add 3 and end at 17, our product, etc.

We will compare the multiplication of $2\frac{1}{64}$ by $2\frac{1}{64}$ under the old and new systems.

Decimal multiplication:	Octimal multiplication:
2.015625	2.01 ($=2\frac{1}{64}$)
2.015625	2.01
10078125	201
4031250	4020
12093750	
10078125	4.0401 Ans.
2015625	
40312500	
4.062744140625 Ans.	

The heavy line indicates the decimal numbers as before.

The reader ought now to be able to locate the value 4.0401 on the scale. (See Fig. 5.) He can test himself by proving the following: $2\frac{3}{64} \times 4\frac{3}{32} = 2.77 \times 4.06 = 14.1572$.

Conversion of fractions from the one system to the other is simplified by the use of Fig. 8. The writer used a conversion chart similar to this in his original calculations, as it was always necessary to convert the octimal calculations into the decimal system before the figure was fit to be used; but often, when it was only necessary to lay off the figure found as a lineal dimension, without recording its decimal value, the regular draftsman's scale, graduated in eighths of an inch, was

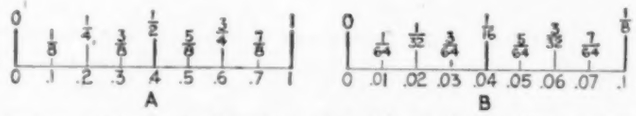


FIG. 8 (A). COMPARISON OF BINARY DIVISIONS WITH OCTIMAL NOTATIONS OF SECOND MAGNITUDE; (B) COMPARISON OF BINARY DIVISIONS WITH OCTIMAL NOTATIONS OF FIRST MAGNITUDE

used. As a matter of fact the writer calibrated his scale so it looked similar to the lower half of *A*, Fig. 8. In division, we must obtain each trial figure for the quotient by reference to the multiplication table, then use Fig. 7 for all multiplying and Fig. 6 for all addition. By following through each step for trial quotient, multiplication and subtraction, in the following example the application of the method to division will become obvious.

```
                .564 +
              -------
5.52)4.071
     3422
     ----
     4470
     4174
     ----
     2740
     2650
     ----
       70
```

From the foregoing we conclude that:

1. Ten is a rationally wrong basis of measuring.
2. Eight or any binary system is just as effectual as ten in computing, but far more effective in measuring.
3. There is available a system of computing and measuring as described in the foregoing which will greatly simplify the work of many engineers, draftsmen, clerks, inspectors, etc., in the mechanical industries or any other industry employing binary measurements, and can be used together with our present system.

A system based on units of twelve could be devised along the lines of the octimal system. If this is the "duodecimal system" which has often been referred to but never intelligently explained, we see that it would be almost as difficult to express and handle those commonly used binary fractions in this duodecimal system as it now is to express and handle them in the decimal system. Another disadvanage would be the larger addition and multiplication tables required to be memorized, but this disadvantage would be offset somewhat by the smaller number of figures required to express large numbers.

Octaval Notation and the Measurement of Binary Inch Fractions*

By Alfred Watkins
Hereford, England

A RECENT investigation into the usage of coinage, weights and measures of all kinds, summed up in the author's pamphlet, "Must We Trade in Tenths," showed two distinct and clashing tendencies. The first, which is prevalent in all branches of commerce and craft, is to divide a unit into halves, quarters, eighths, etc., down to sixty-fourths. The stock broker, farmer, corn dealer, or auctioneer does this with his sovereign; the liquor dealer with his pound; the draper with his yard; the mechanic and engineer with his inch. And in many cases this is persisted in in the face of an awkward customary notation, as when shares are sold in 32nds of a sovereign, and the mechanic has to measure his $\frac{1}{31\frac{1}{2}}$ in. with a micrometer which, though it uses four places of decimals, does not measure correctly. This last example is the reason for the present paper.

The second tendency is on the part of the man who has more to do with computation than actual exchange or craft. He, finding a decimal notation all cut and dried and usable with easy facility, is thoroughly impatient with any other method, and wants it to be universal and compulsory. To this class belong the counting-house man, the schoolmaster, and the scientist, who have never entered into the unexplored science of commerce and handicraft.

And as we all, with a slight exception in dozens, count upward from unity in a ten grouping, many of us are apt to decide that the ten grouping is also an inevitable division of the unit downward. But this ignores the general fact that no market man or craftsman does divide a unit into tenths until forced by the counting house into doing so. The figure ten only halves once into a whole number, and after that each halving adds an additional decimal place. The ten grouping is not the only scale of notation and such textbooks as Hall & King's Elementary Algebra point out those with a basis or radix of 6, 8, 12, 16, or any other numbers and give rules for the conversion of one notation to another. It is exceedingly unlikely that we shall disturb the ten grouping for our counting from unity upward. But there is not the slightest difficulty in expressing parts of a unit in modern fractions of some other radix than 10.

Unfortunately there is no notation which fits perfectly with all fractions used in commerce or craft. The three groups of fractions most used are 3rds, 6ths, and 12ths; 5ths and 10ths; and the binary group, 4ths, 8ths, down to 64ths. The last group is undoubtedly used more than all the others put together, especially in the mechanical division of a unit of length, and a numeration with a binary radix is best. As a radix of 16 would necessitate the selection of six new numbers, 8 is the scale of notation to select, and it fits the engineer's binary inch fractions to perfection.

Table I explains the perfection of the octaval notation and the faults of the decimal notation for binary division. An octaval fraction is distinguished from a decimal fraction by a special mark, the small circle or "pip," originated by the author, and placed in the same position as the decimal point.

*From a paper presented at the Annual Meeting of the A. S. M. E., December, 1919, in New York City.

TABLE I. OCTAVAL NOTATION CONTRASTED WITH DECIMAL NOTATION

Units		Fractions		
Decimal	Octaval	Vulgar	Decimal	Octaval
100	64	1	= 1	= 1
50	32	$\frac{1}{2}$	= 0.5	= ₀4
25	16	$\frac{1}{4}$	= 0.25	= ₀2
12.5	8	$\frac{1}{8}$	= 0.125	= ₀1
6.25	4	$\frac{1}{16}$	= 0.0625	= ₀04
3.125	2	$\frac{1}{32}$	= 0.03125	= ₀02
1.5625	1	$\frac{1}{64}$	= 0.015625	= ₀01
		$\frac{1}{128}$	= 0.0078125	= ₀004
		etc.	etc.	etc.

Octaval fractions can be added, multiplied, etc., with much the same facility as decimals and far easier than vulgar fractions as for example:

Vulgar	Octaval
$\frac{1}{2} + \frac{33}{64} = \frac{32}{64} + \frac{33}{64} = \frac{65}{64} = 1\frac{1}{64}$	₀4 ₀41 1₀01

Note that as 8 is the radix, it becomes 10 in all octaval arithmetic.

In the structure of octavals, just as 0.2345 in decimals

$$= \frac{2}{10} + \frac{3}{10^2} + \frac{4}{10^3} + \frac{5}{10^4}$$

$$= \frac{2}{10} + \frac{3}{100} + \frac{4}{1000} + \frac{5}{10000}$$

so ₀2345 in octavals $= \frac{2}{8} + \frac{3}{8^2} + \frac{4}{8^3} + \frac{5}{8^4}$

$$= \frac{2}{8} + \frac{3}{64} + \frac{4}{512} + \frac{5}{4096}$$

Application to Inch Fractions

The foregoing explanation leads up to the subject of this paper, which is the practical application of octaval notation to the construction of micrometers, calipers, and measuring rules, and the great ease and facility it imparts to the measurement of the allowances and limits so much used in precision work.

In most British and American works the binary inch fraction is still the favorite standard, and as has been pointed out, this instinct is a sound one, although the crude way in which these are expressed in vulgar fractions leads to great inefficiency. How can such adjacent figures as $\frac{1}{2}$, $\frac{33}{64}$, $\frac{17}{64}$, $\frac{33}{64}$, and $\frac{9}{16}$ be marked on a scale or rule, or conveniently used in calculation? The consequence is that they are never marked, and we are so accustomed to the inefficiency caused by the omission that we do not notice it.

A beginner recently asked for an explanation of the reading of a vernier calipers. The particular instrument in question reads down to $\frac{1}{128}$ and is a pattern sold under different names. No instructions are sold with it; not a figure is marked except for full inches; the inch is divided into 16 parts, the vernier into 8 parts. There are no index lines given; therefore, the unhappy beginner has to guess which is the index line and to find out which of the divisions it indicates by counting them; then to do the same with the vernier divisions. But results have to be kept in mind, and such a result as five-sixteenths in the main divisions, and five one hundred and twenty-eighths added together and reduced in the head to the conventional vulgar fractions.

This crudity in the notation of our binary fractions, and the inexplicable neglect of the logical fractions with a binary radix, compelled the makers of micrometers, when precision work became necessary, to

translate the binary fractions into decimals and construct their instruments on that basis, with the imperfect and illogical consequences already pointed out.

The honest mechanic, who deals in sixteenths of an inch, and knows them mentally as quarters of a quarter of his unit, is complacently told that he must now measure them as six hundredths, plus two thousandths, plus half a thousandth of an inch. And when it comes to the necessary sixty-fourths, which ought to take six decimal places down to thousandths of thousandths, the instrument maker gives it up in despair and makes four places do. This omission makes a micrometer measurement (on the usual instrument) of 32nds and 64ths short of the true value, 0.00005 in all 32nds and either 0.000025 or 0.000075 alternately in all 64ths. This may seem unimportant but it may amount to one-third the "limit" in certain items in the Newhall tables and

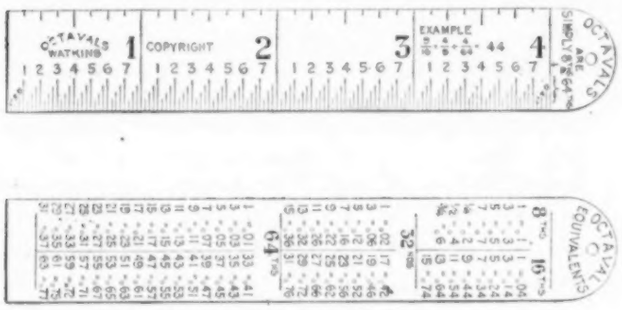


FIG. 1. OCTAVAL RULE

to one-half the "limit" in certain items in the table in the Johansson catalog.

Our present crude blend of decimal allowances with standard binary fractions is complex and illogical, and it would seem that as a "limit" table is based on the square root of the diameter of the part, it can be more accurately and simply compiled in octavals than in decimals. The structure of an octaval fraction is much on the lines of a mechanic's mental conception of the fraction. Thus .42 (that is, $\frac{1}{4} + \frac{2}{64}$) for the fraction usually called $\frac{17}{32}$ is obviously half an inch plus a thirty-second.

It should be also noted that the octaval figures are continuous, so that adjacent fractions as $\frac{1}{2}$ and $\frac{33}{64}$, so inconveniently expressed now, are in octavals .4 and .41, obviously adjacent. With an octaval radix the counting omits 8 and 9, and goes directly from .07 to .1, from .17 to .2 and so on until .77 is reached, when the next value upward is 1.0 or unity. The octaves of the eighties and nineties are omitted, as well as the single figures 8 and 9.

Measuring Instruments With Octaval Notation

It will be noticed that in the instruments illustrated (Figs. 1–5) all or almost all the divisions can be marked with figures indicating their value, and that, except in the case of the rule, there are no very fine divisions to try the eyes. It should also be noted that in each case there is a separate scale for each place in the fraction, each figure of it being read separately, so that no addition is necessary to get the results.

Octaval Rule—The octaval rule, Fig. 1, shows that all the eighths are figured, and the figures form the first place in the octaval fraction. The writer has devised an original way of indicating the subdivisions of the eighths (the sixty-fourths) in staircase fashion which enables the alternate even number to be marked, and these numbers constitute the second place in the octaval fraction. This method of a different length of line for 2, 4, and 6 allows the value of the indicated division to be known, even if it is not uncovered by the thimble or sliding bar of a measuring instrument. It is applicable to decimal divisions and to ordinary and slide rules.

Simple Calipers—The simple calipers shown in Fig. 2 measures the standard fractions down to 64ths, employing the staircase subdivisions described. In place of making the edge of the sliding jaw uncover the division, an indicating line, as illustrated, is used, as it is more exact for observation. The jaw is cut away

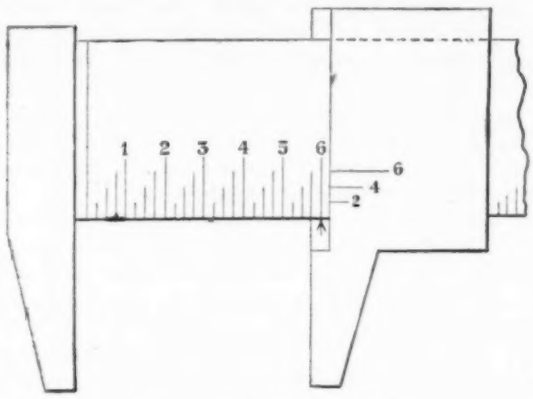


FIG. 2. SIMPLE CALIPERS

a little to allow of this arrangement. The values of the different division, of different lengths, are marked by horizontal lines, also of corresponding different lengths, on the jaw itself. This enables each division to be figured with its value. The author considers that 32nd divisions are quite fine enough for convenient observation on a scale, and therefore he has not inserted the odd 64ths, these being indicated by setting the index line midway between the two divisions.

Simple Vernier Calipers—The simple vernier calipers shown in Fig. 3 measures down to 64ths, and yet the divisions are scarcely finer than eighths. The vernier method is used, and every division is figured. The index line points to the first figure of the fraction, or beyond it, short of the next division, and the vernier line which coincides with any upper division is marked with the second figure of the fraction. A partial dislike to the vernier method is probably due to their usual association with fine, eye-straining divisions. Here it is applied with coarse divisions. The scales representing the first and second octaval places have been marked with the distinguishing letters *A* and *B*. This marking will also be on the other instruments, with *C* and *D* added for the 3rd and 4th octaval places.

Double Vernier Calipers—A flat model of the double vernier calipers is illustrated in Fig. 4 in order to show its action more plainly, although it is quite probable that a model with a circular stock will be the commercially useful one. The standard fraction is set, in two places of octavals, exactly as in the instrument already described. A fine movement for the 3rd and 4th octaval places is frictioned on the coarser movement. It is a double wedge with a taper of 1 in 32, and a movement of $\frac{1}{16}$ in. on this cross-slide moves the calipers .12 or .001 in the third place of octavals. The fourth octaval place is indicated by a vernier scale.

In this, as in the next instrument, the 1st, 2nd, 3rd and 4th scales are lettered *A*, *B*, *C* and *D*. The advantage, to which reference has been made, of devoting two scales to the main fraction and the two others to the allowance, shows up very strongly in this instrument, for there is a separate plus and minus scale for the allowance. The mechanic has therefore only to set one part of the calipers for his main fraction and the other part for his allowance, either plus or minus, and has no pencil or mental calculation to make. No decimal instrument can do this unless the standard main fractions adopted are tenths or hundredths. It will be noticed that the construction remedies a fault in previous beam calipers which had the pull of the fine adjustment on one side of the main axis of the instrument. When used to caliper the exact size of an unknown dimension, the jaws are adjusted to the size, and a front clamping screw, not shown, is tightened on the beam, the rear screw being left loose. The fine adjustment is then worked so that a vernier line on the scale *B* coincides with an upper division. The *C* and *D* scales then indicate the variation from the standard fraction. It should be noted that this construction makes the reading of the second place of the fraction different from previous instruments. With this one it is always set exactly for the precise standard fraction, and the fine adjustment does not alter this setting, but indicates how much more, or less, than the standard the dimension is, or is intended to be.

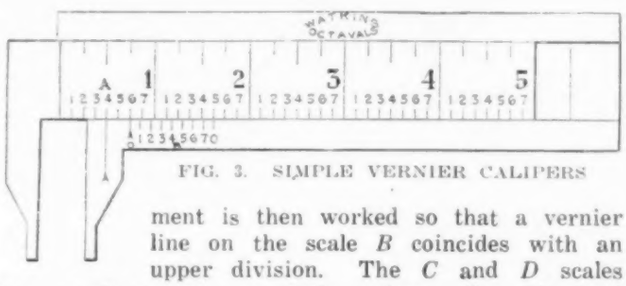


FIG. 3. SIMPLE VERNIER CALIPERS

Single-Screw Micrometer—A screw micrometer, bow type, is probably much more used than a sliding calipers. The octaval one first designed by the author is on the same lines as the usual one, but the screw is of 32 pitch and the scales are so arranged that each place in octavals is read separately, the one screw motion reading to four places. The usual micrometer reading in 0.025's mixes up two places. This pattern is not described more fully because, although completely efficient, it does not bring out the strong points of the separation of the standard fraction from the allowances so completely as in the next instrument.

Two-Screw Micrometer—The two-screw micrometer shown in Fig. 5 is the result of the author's conviction that the separation of the scale for the main fraction from that of the allowance, rendered possible by their being expressed by different places in octavals, is a great practical convenience. In this instrument the standard fraction is measured by the usual screw on the right hand. It is of 8 pitch, probably 4 threads. It indicates the first octaval place, eighths, on the index line, which also points to the 8 divisions on the thimble for the second octaval place. For measurement of the main fractions this is all that is required. The end usually occupied by a fixed anvil is fitted with a measuring screw for the allowances, 3rd and 4th octaval places, which is kept at zero until required. This is a 32-pitch screw, it has a range of one revolution only, and its thimble has a double scale starting each way from 0 for plus or minus allowances. The 4th octaval place is read by a vernier scale. The workman therefore sets his standard fraction on the coarse screw, turns the micrometer round, and sets his plus or minus allowance on the fine adjustment, there being no calculation either for him or for the draftsman. As illustrated, the fine adjustment was used left handed, but it would probably be figured to use it on the right hand, and the position and the use of the vernier would then be exactly those that workmen are familiar with in the present instruments.

To measure an unknown dimension in four places of octavals the coarse adjustment is first set to the article, which is then withdrawn and the screw turned in to register the nearest (smaller) standard fraction. The final measurement is then made with the fine screw, which would probably be fitted with a ratchet, and the instrument would then read for the four places of octavals expressing the dimension. The fine-adjustment end can be used alone for measuring fine dimensions less than $\frac{1}{64}$ or the coarse-adjustment screw alone for the main fractions.

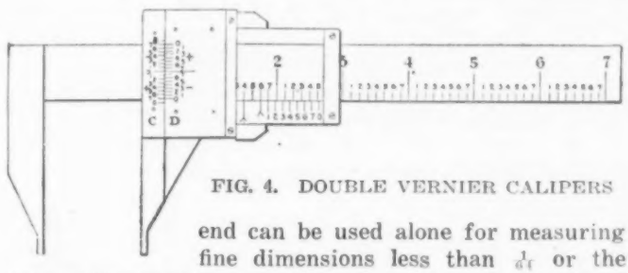


FIG. 4. DOUBLE VERNIER CALIPERS

An alternative arrangement in the construction of the instrument is to use a sliding rod, or anvil, in place of the coarse-pitch screw, and to adjust this for the main fraction by a set of standard blocks as described in the third from last paragraph, the fine-adjustment screw measuring for the plus or minus allowance. It might be commercially desirable to issue both of the above types of instrument with the fine-adjustment screw of 50 pitch and the scale decimal. This would work with the present limit tables.

Simplifications in Measuring "Limits"

The fact that all the standard binary fractions are expressed in the first two places of octavals and that all the limit allowances and tolerances come in the next (third and fourth) octaval places, gives a new and unexpected value to octaval notation. The workman sets his standard size on two scales of the calipers or micrometer, and the plus or minus allowance on two different scales. No pencil or mental calculation of adding or deducting is required. Another happy fact which makes the provision of limit tables for octavals very easy, is that the third place in octavals (.001) is .$\frac{1}{32}$, and half this (.0004) is .$\frac{1}{64}$, which is so near the much used "thou" of the mechanic (within $2\frac{1}{2}$ per cent of it) that it can safely be substituted for it in all the limit tables. Accepting this substitute we obtain the following equivalents:

Decimal	Octaval
0.00025	.0001
0.001	.0004
0.002	.001
0.003	.0014
0.004	.002
0.005	.0024
0.006	.003
0.007	.0034
0.008	.004
0.009	.0044
0.01	.005

Another fortunate coincidence is that the well-known Newhall table of limits takes a quarter of a "thou"

(0.00025) as its smallest unit and all the figures in the table are multiples of this. As this unit is .0001 in octavals (the lowest figure read on the octaval micrometer described) the Newhall table can be given and used as an octaval table with perfect ease. A dot is placed between the 1, 5, 2 divisions on the calipers and micrometer, so that the mechanic has available his familiar thousandths division.

The economy in building reference blocks up in binary series instead of a numerical series (as in the Johansson series) has not been recognized. To illustrate the point, the usual commercial pile of weights from 4 lb. to ½ oz. is cited, each half the weight of the next larger. The total weight of the series is ½ oz. less than 8 lb., and its perfection as a series is such that it, without any duplicate weights, will weigh anything within its limits to ½ oz. Any binary series either of weight or thickness has a similar perfection. No weights or measures selected from a decimal series can approach it.

Finer "Limit" Measurements

Supposing 9 similar blocks be taken from 4 in. thick down to $\frac{1}{64}$ in. thick, standing exactly 7.077 in. high ($7\frac{9}{64}$ in.), any possible dimension in 64ths from .01 ($\frac{1}{64}$) to the limit named could be calipered from it for

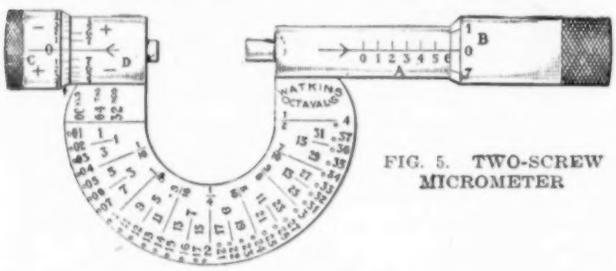


FIG. 5. TWO-SCREW MICROMETER

precision work. For finer "limit" measurements some modification would have to be made, but the total number would come far below those in the Johansson series of 81. Considering the great expense of such standard blocks, this is important.

In conclusion, it should be stated that this paper is not a proposal for the substitution of octavals for decimals in all branches of engineering. It advocates their use to denote the British binary inch fractions in the workshop and on workshop precision instruments. Any use beyond this, and there are many, is for future experience. A maker adopting these in workshop practice need not bring them into his catalog until their simple logical structure is better known.

Machine Tools for the Belgian Commission

Our Washington correspondent has just sent us the following list of unfilled requirements of the Belgian Commission which came over here to select machine tools for its country from the surplus stock of the War Department.

The tools enumerated on the list have so far not been found among the War Department's assortment and must be supplied from the stocks of the builders and dealers of this country.

Further information may be obtained from the office of the Director of Sales, War Department, Munitions Building, Washington, D. C.

Here is the list:

Lathes	Stud	2	
	Engine	136	
	Toolroom	4	
	Automatics	21	
	Chuck and turn	1	
	Turret	10	
			Total 174
Screw machines		15	
	Automatic	19	
	Turret	9	
			Total 43
Millers	Hand	2	
	Universal	7	
	Plain	1	
	Briggs	2	
	Vertical	9	
			Total 21
Slotters			9
Gear cutters			59
Cranes			4
Air compressors			2
Boring mills	Vertical	73	
	Horizontal	23	
			Total 96
Bolt and Nut Machinery			46
Drills	Radial	16	
	Upright	44	
	Multiple Spindle	25	
	Sensitive	10	
			Total 95
Grinders	Universal	4	
	Universal tool and cutter	3	
	Plain	6	
	Tool	3	
	Emery	23	
	Wet Tool	5	
	Internal	5	
	Twist Drill	3	
	Cylinder	4	
	Miscellaneous	10	
			Total 66
Hammers	Drop	1	
	Air	14	
			Total 15
Planers			6
Shapers	Crank	39	
	Traverse	19	
			Total 58
Saws	Circular	1	
	Cold	3	
	Friction	1	
			Total 5
Cutting-off machines			16
Punches and Shears			53
Key seaters			8
Presses			27
Furnaces			1
Centering machines			3
Sheet-metal working			8
Motors			7
Woodworking			28
Miscellaneous			39
Grand Total			889

Nickel Babbitt Minus Nickel

The name nickel babbitt does not always indicate that the alloy so designated contains nickel, as the effect of nickel on babbitts is similar to that of copper. As a matter of fact many such alloys contain no nickel. A nickel babbitt can be made as follows: Copper, 4 per cent; nickel, 0.5 per cent; antimony, 10 per cent; and tin, 85.50 per cent.—*Foundry.*

A Letter on Spoiled Work

Cleveland, Ohio, Jan. 31, 1920.

There is nothing unusual in our method of handling scrap with perhaps one exception—that we insist upon the foreman of the department signing his name to a detailed report of all the scrap made in his department. He also knows that a copy of this report goes to the superintendent, and also to the accounting department.

All scrap from each department is kept separate and is accumulated for thirty days, and at this time a post-mortem is held by the assistant superintendent and foreman on all this material.

The reason for keeping this material for thirty days is to impress the men responsible with the volume of scrap.

There is a very noticeable difference between a foreman passing two or three pieces of scrap daily and passing a large quantity of scrap at the end of thirty days.

The Peerless Motor Car Co.,
W. S. Staring, Factory Manager.

What Other Editors Think

Congress and the Merchant Marine

FROM *New York Times*

IN GIVING his views about the American merchant marine General Leonard Wood avoids details, as does almost every public man who ventures to say something about this irrepressible and difficult problem. All agree that we should have cargo carriers under the American flag in sufficient numbers to transport American products to all parts of the world. It is like the question of continuing to pay rent when a man should own the house he lives in. Why pay the British, Norwegians and Japanese for cargo space when we can build and operate our own ships? The war gave us our opportunity. Ships were built by the gross to carry troops, munitions and supplies to Europe, and the war over the building program was continued in order to found an American merchant marine and put the Stars and Stripes in ports where for forty years it was rarely, if ever, seen. "Let us see to it," says General Wood, "that, to as large an extent as possible, they (the ships) remain in the hands of Americans." He adds that "the Government will have to sell its ships at considerable loss," and there the General stops. He does not trust himself to details. He steps wairly.

Some questions of prime importance remain unanswered. Can the ships be sold cheap enough to tempt firms and companies to buy? What Government control shall there be over private operation, if any? Would it be expedient for the Government to lease some of its ships, retaining title? Is Government ownership to have any consideration? Can officers be provided for as large a merchant marine as would be able to compete with the British before they got the cream of the ocean-carrying trade? Can crews be obtained and kept at living wages, American standards? Is it practicable to operate American ships profitably without amending the navigation laws? Would passenger ships pay in competition with foreign liners not handicapped by prohibition laws?

The American merchant marine is in an inchoate state, waiting for Congress to do something, with Congress reluctant, backing away, fearful. The problem must soon be dealt with courageously and with resolution. One thing is certain—if those questions relating to operation cannot be answered satisfactorily, the sun rising on the American merchant marine will be obscured by clouds.

How To Increase Production

FROM *Manufacturers' Record*, BALTIMORE

INCREASED production on the farm and in the factory by intensive work, without any decrease in wages, should be unceasingly urged by every employer; but let us dismiss any thought of lower wages, for low wages are unfair to the laborers, and they breed suffering and unrest and Bolshevism. We must accept high wages and rejoice that the laboring man can through this change enjoy more of the comforts of life.

Low wages are in the end the costliest wages; low wages always have been unprofitable. The South was for years tremendously handicapped by low wages.

The laboring man has a right to receive more pay than in the past, and the public is the better off for the higher wages now paid.

If the people of this country will universally accept these truisms, they can then effectively give their attention to urging increased efficiency.

The man who was underpaid and who knew it was never in the frame of mind to produce the best results. Unhappiness and even hatred were gnawing at his heart in protest against the injustice which doomed him to want amid the luxury of the increasing wealth of the country. Laboring men as a whole are not different from other men—all are very much alike. Many of them are misled at times, but how many millions of others more blindly follow politicians than labor men blindly follow their false leaders?

"Come, let us reason together" should be the spirit of employers and employees. Let them come together and study each others' problems, and while employers should stand unalterably upon the right of the open shop for every man who wants to work, they can go a long ways to create a spirit of efficiency and production by a spirit of co-operation and sympathy.

Costing

FROM *Mechanical World*, ENGLAND

ALTHOUGH a great deal is heard from time to time of costing systems in relation to scientific management, there is plenty of evidence that insufficient attention is given to this important matter.

There is too great a disposition to place works costing systems in the hands of any superior clerk, whereas, of course, works costing is really an intricate affair and demands some knowledge, at any rate, on the part of a works assistant, of the particular business. Too much reliance is placed on the advice of the chartered accountant when he comes in for his periodical audit, whereas, in fact, the functions of a works accountant and the chartered accountant are widely separated in the sense that the former's duty should be to provide the works manager or the managing director, or both, with weekly figures, or, at any rate, continuous figures which will assist the management to come to decisions on matters affecting the policy of the business. It will therefore be seen what an important post that of the works and costs accountant should be.

It is with the object of improving the status of works and costs accountants and of providing them with some emblem indicative of proficiency that the Institute of Works and Costs Accountants has been formed, and it is quite clear that in the engineering industries there is great scope for the activities of such a body. The difficulties which arose between controlled firms and the Ministry of Munitions were eloquent of the manner in which even chartered accountants often fail to appreciate some of the finer points in works accountancy; and, perhaps, nothing was more striking in this connection than the question of overhead charges.

AMERICAN INDUSTRIAL MILL
WATCH WHEN I PUT THIS IN !
MACHINE TOOL MOTOR THE SOURCE of all POWER
WORLD TRADE CLUB
WOOLEN
AMERICAN MACHINIST
Brey

IT WON'T MESH !

The Compulsory Metric Law

Read This—and Then Get Busy

THE World Trade Club is sending out to all parts of the country, thousands of post cards, addressed to the Bureau of Standards, Washington, D. C., urging legislation in favor of the *exclusive* use of the meter-liter-gram in the United States.

These cards are being signed by doctors, lawyers, school teachers and all sorts of people who know absolutely nothing of real manufacturing or export conditions.

Probably a hundred thousand of these cards have been mailed to Washington favoring one side of the question only, and many Congressmen have been led to believe, in looking over the reports on this flood of cards, that the whole country wants a compulsory metric system, when in fact nothing is farther from the truth. This dangerous propaganda *must be counteracted* by the same means the "millionaire's club" has employed.

Now—Mr. Manufacturer—Mr. Exporter—Mr. Man—**You** whose **very existence** depends on the smooth running of our industrial machinery which would be hopelessly crippled by a compulsory metric law—**all of you turn in and help in this campaign by taking up our proposition.** Also get the help of every association you belong to.

Chairman of Committee on Coinage, Weights and Measures,
House of Representatives,

Washington, D. C.

I am against all legislation tending to make the use of the metric system compulsory in the United States.

*Name*_____

*Address*_____

_____

*Vocation*_____

Here is our proposition! We will furnish you, **free of charge,** all of the post cards you can use, similar to the one shown. Distribute these cards to your employees and have them sign and mail them. The cards are all properly addressed and need only to be signed and a one-cent stamp affixed and then they are ready for mailing.

Ask us for enough cards for every employee you have and all their friends who are against the proposed compulsory metric law.

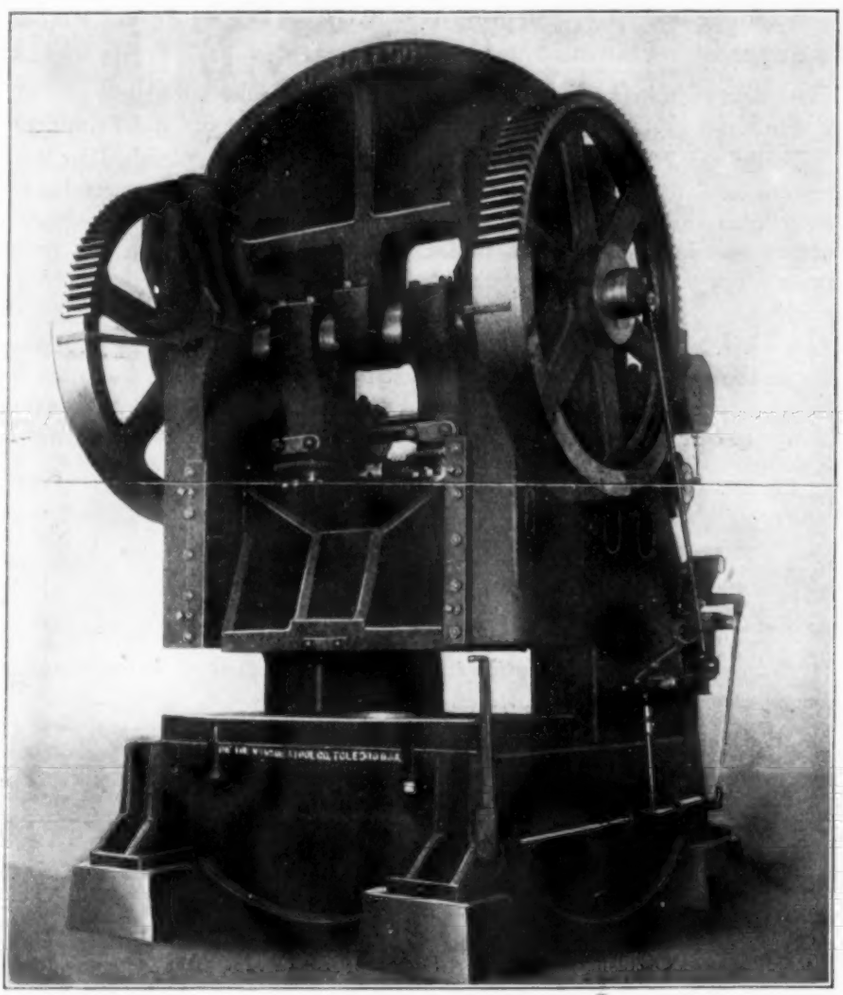
Thos. Viall

Editor

A Giant "Toledo" Power Press

The work of large power presses is now seen in many branches of industry, the stream-line body of the automobile being a good example of such work. The development of these useful machines has progressed steadily to meet the demands of designers of large commercial shapes.

WHAT is believed to be one of the largest deep-gap, double-crank presses that has ever been built, was recently completed in the shops of the Toledo Machine and Tool Co., Toledo, Ohio. The illustration gives a good idea of the design, but not of the size, as it stands eighteen feet seven inches above the floor line and weighs 175,000 pounds.



A GIANT TOLEDO POWER PRESS

The frame is unusually massive and is of the four-piece steel tie-rod type of construction, the main stress being taken by two large steel tie rods 9½ in. in diameter running from the bottom of the bed to the top of the arch directly in back of the main gears. There are also two tie rods located in front of the bearings which hold the press together in a most substantial manner. The uprights are extra heavy to take care of the re-action and any lateral stresses. The feet of the uprights are made especially long and there is a pair of tie rods at the extreme back of the press, which, in addition to the main tie rods, bind the uprights securely to the base.

The power is supplied by a 30-hp. motor running at a speed of 1200 r.p.m. allowing the press to make twelve strokes per minute. The twin-gear drive has a ratio of 29 to 1 and is well protected with guards. The large gears are each 86 in. in diameter with a 9-in. face; they are made from steel castings and the teeth are cut from the solid.

The crankshaft is 12 in. in diameter and is supported in 11-in. bearings.

The gearing is all self-contained so as to leave a space around the machine available for stock and other purposes. The two pitmans are adjusted simultaneously by means of screws operated by bevel gears, which may be noted from the illustration.

The press being specially designed for blanking it does not have a very long stroke and of necessity would not require a great amount of adjustment.

An item of particular interest is the clutch-operating mechanism. This is so arranged that the press may be started or stopped at any point of the stroke by means of the hand lever shown in the illustration, or by throwing backward a small weight shown in connection with the mechanism, the press will automatically stop at the top center. An idea of the magnitude of the machine may be had from the following dimensions: Distance from bottom of frame to top of arch, 223 in.; floor space over all, 150 x 159 in.; distance between uprights, 60 in.; distance from center of slide to housings, 20 in.; area of slide, 40 x 60 in.; area of bed, 56 x 85 in.; opening in bed, 24 x 56 in.

The press is known as No. 210-A and is particularly adapted for large blanking of the heaviest kind of stampings which are frequently used in automobile and other work of a similar character.

Some Effects of "Compulsory" Use of the Metric System

By C. C. STUTZ

IRRESPECTIVE of any merits the metric system may have, the country in case the system is made compulsory will have to face:

1. A long *transition period.* As a matter of fact, old units never disappear. After eighty-three years of compulsion in France some of its industries, as, for instance, the textiles, still use the old units. Besides, 80 per cent of all screw products of the world are today manufactured on the "inch" basis, as found by the National Screw Thread Commission which met in Paris, France, in the fall of 1919.

2. The introduction of a *dual* system, because the habits of people cannot be legislated away.

3. A *confusion* between the two systems, becoming a most prolific source of error and expense.

4. A *cost* appalling in its magnitude, represented by the change involved in deciding on new standards, making new drawings, tools, fixtures, etc., which would seriously threaten during the transition period at least our system of "interchangeable" parts, this bulwark of our industry.

5. The *re-calculation* and establishing of new prices for every commodity raised and manufactured to conform with the new standards of length, weight and volume. In practically all such calculations the results will come out in fractions. If the higher value be taken the customer pays an increased price; if the lower be taken the seller loses.

6. The re-calculation of compound units and their use, such as pounds per square inch to kilograms per square centimeter; foot-pounds to meter-kilograms; English horsepower to metric horsepower, etc. Example:

1 lb. per sq.in. = 0.07030954 kg. per sq. cm.

1 kg. per sq.cm. = 14.222820971 lb. per sq.in.

7. The twofold application of the metric system, that is, one man may keep in the article he makes, say the dimension of 3 in. and call it 76.2 mm., another may change it to 75 mm. in order to avoid the fraction; thus standardization is no longer possible.

8. Even should Congress, as a preliminary measure, make the metric system compulsory only for the departments of the Government, the country would feel the effects of such legislation. This becomes apparent when we consider such a Government agency as for instance the Post Office or the Interstate Commerce Commission.

9. Thus we shall have: Complexity instead of simplicity; confusion instead of order; diversity instead of uniformity, and extra expense all around.

As far as the relations of the governmental departments to each other are concerned the general public would not be affected, except that Government reports would not be intelligible to the average man.

All departments come in touch with the daily and industrial life of the nation to a greater or lesser extent, and being obliged by law to use only the metric system would thereby create an intolerable situation.

The Post Office Department probably comes into closer touch with the public than any other. Postage rates go by weights, sizes of packages are restricted to certain dimensions. It can readily be seen what the effect would be should the department be obliged to insist on metric units.

Not in as close a touch with the general public, but affecting large interests, are many departmental sub-divisions or bureaus, as for instance the Interstate Commerce Commission. Being an integral part of the machinery of the Government and therefore bound by such a metric law, the Commission would ask that all reports petitions and statistics it requires and receives from the railroads be given in metric units. Its decisions rates and rulings would likewise be thus expressed. The railroads, using the present system of measurements, would thus be twice compelled to translate all figures submitted and received. The enormous amount of energy thus uselessly expended can only be realized by those familiar with this subject.

All governmental departments are large purchasers, and some are also producers. If specifications for goods to be bought call for these articles to be made to the metric system, it stands to reason that if they are obtainable at all, they will cost more and this added cost will have to be raised by increased taxation.

This article is especially valuable in view of the fact that Mr. Stutz is a mechanical and electrical engineer with thirty-four years' professional experience. He was educated in Switzerland and brought up to the use of the metric system. He came to the United States and became a naturalized citizen in 1890. After he came to the United States he familiarized himself with the English system of measurement and used it for about twelve years. He then spent several years in Europe as sales engineer for an American firm and then as chief engineer and shop manager of a large and well-known European concern building machine tools, engines, printing presses and special precision machinery. While with this firm he again used the metric system. On his return to the United States he once more took up the use of the English measuring system. From this, it will be easily seen that he has had exceptional chances to become familiar with the workings of both the metric and English systems in actual shop practice and in general engineering work. He considers that while neither system can be called perfect, his experience has taught him that the English system presents such decided advantages over the metric—especially when it is considered from the standpoint of the workman who after all represents the great mass of its users—that he is unalterably opposed to the making of the use of the metric system compulsory. He considers the inch with its divisibility to which the workman takes so readily, to be the foundation for the superiority of American machine design. In measurements of precision, our method of "interchangeable parts" has as its foundation the thousandth part of an inch, which is a dimension as readily used by the workman as the inch itself.

Only a brief outline can be attempted as to what will be required of the various railroad departments.

Tariff Department—Every item of the numerous tariff lists will have to be re-calculated to conform to the new dimensions, weights, volumes, distances and car dimensions.

Claim Department—Many shippers will not understand the new units, from which will arise errors, misunderstandings, claims and general dissatisfaction.

Freight Agents—The education of this force, scattered as it is along the line, will be a task of no mean proportion.

Purchasing Department—All existing specifications will have to be re-written. All commodities bought will have to be called for in metric units, with prices as per the new unit.

Real Estate Department—All deeds, plans, surveys, drawings and descriptions of properties, rights of way, etc., will have to conform to the new system and valuations figured as per new units.

Maintenance of Way Department—All earth, stone, gravel and brick work, fills, excavations, etc., will have to be ordered and executed in cubic meters. Mile-stones to be replaced by kilometer signs, etc.

Car Department—All capacities and weights marked on cars are to be changed to metric units; spare parts and repairs will have to be called for in the new language.

Engineering Department—Locomotives and all mechanical and electrical equipment of freight and passenger cars will have to conform to the new units as well as all apparatus for block and signal systems. Thousands of drawings will have to be changed in every office. The great difficulty the engineers will experience, however, will be from the fact that all engineering tables will have to be re-calculated, and this cannot be done until new standards have been agreed upon.

Accounting Department—The difficulties of this department, especially during the transition period will be very considerable. All printed forms will have to be revised.

Plan To Effect Co-operation between Industry and Schools

Realizing that technical schools are not serving to a maximum degree the industrial market to which they owe their existence, the Technology Clubs Associated, through their president, have called a meeting to be held at the Drexel Institute, in Philadelphia, on March 25, 26 and 27.

Dr. Hollis Godfrey is now president of the combined Technology Clubs Associated. As chairman of the engineering-education section of the Council of National Defense, during the period of the war, he foresaw the alarming shortage of trained men. He saw that there was much waste in present technical education and that to eliminate this waste, industry must be called upon to specify exactly what they require of the graduating engineer. The following plan was therefore formulated. Since that time every detail of the plan has been worked out and will be presented at the comming meeting in Philadelphia.

A number of industries seeing the need for betterment, each contributed $2,500 to carry on the study, and besides gave much of the time of their executives. Educators who were also engineers were sent out into the industry. They made a study of manufacturing processes to determine what knowledge was essential if men were to be successful in the various fields. They called conferences of executives and obtained facts regarding training from them. They sat in foremen's shop meetings, and talked with the operators at their machines. They made every effort possible to determine industrial demand upon the educational institution.

Their findings, together with the suggestion of the representative plants visited, were submitted to a board of educational experts who outlined courses and formulated plans to meet the industrial demand with the possible educational supply.

At the winter meeting of the Technology Clubs Associated there will be gathered representatives of educational institutions and of industry. At that time a composite plan for future education will be worked out. The results of preliminary studies and of the meeting will be put into a permanent record, in book form and in terms common to all concerned.

It is believed that a greater and better industrial America will evolve from this effort to bring about co-operation; that it will improve the quantity and quality of technical men with a reduction of cost in time and money; that it will increase production and increase industrial co-operation because all industrial history shows that these increase in proportion as technical knowledge and training increase; that it will accomplish these ends swiftly and with minimum friction because it is adapted to the human needs and desires of all those concerned with it.

The March meeting of the Technology Clubs Associated is undoubtedly the most authoritative meeting of the year, a meeting which will mark the beginning of the new era in educational-industrial co-operation.

One plant has eliminated the danger caused by falling over trucks left in dark corners by careless truckers by painting the trucks white.

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and • equipment •

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs • and equipment •

Prestometer Attachments

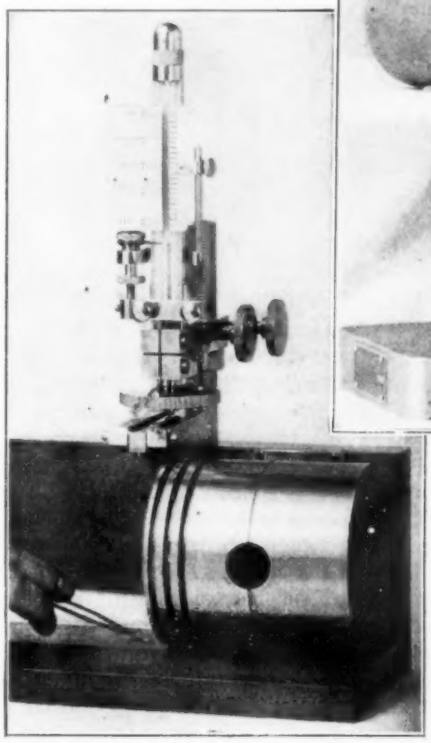
The Coats Machine Tool Co., Inc., 110-112 West 40th St., New York, has brought out three attachments for the prestometer which are illustrated herewth.

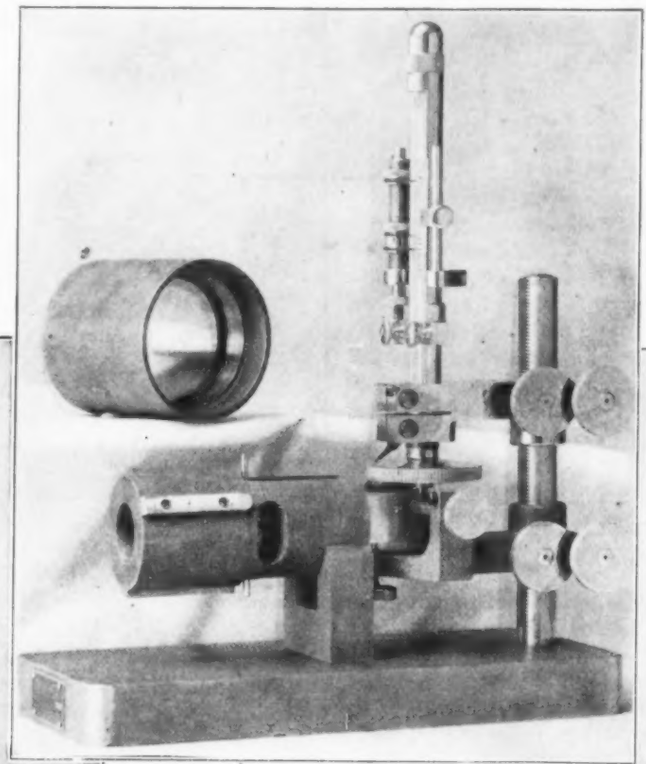
Fig. 1 is an attachment for gaging the bores of Hoffman ball races. The nose of the anvil block will accommodate races of one diameter only, interchangeable blocks being used for races of different diameters.

The gaging point, the location of which is indicated by the pencil, is connected to the instrument contact-point by a floating lever having a two-to-one reduction. It is evident that by changing the position of the race on the anvil by sliding and revolving, the gage readings will show if the hole is bell-mouthed, taper, oval or out of parallel, as well as indicating if the diameter is correct.

As the limits on this particular work are very close (+ 0.0002) (—0.0001), a glass having a very small bore is used for the indicating fluid, giving a magnification of 3,000 diameters. The graduated scale is 3 in. long, and the graduations are 0.30 apart, each graduation representing a 0.0001-in. variation in the diameter of the piece being gaged.

An attachment for gaging a 4½-in. diameter piston is shown in Fig. 2. In this case, as the limits are not so close as in the case of the ball races, the tube is made with a larger bore, the magnification being 250 diameters. As the gaging point and the instrument contact-point are connected by a two-to-one reduction lever, each ⅛ in. on the scale represents 0.001 in. in the work. The anvil indicated by the pencil is a ¾-in. ball supported by a setscrew from below and a cup from above, and can thus be set to project beyond the surface of the base. In this case it is set to project about 0.011 in. so as to contact with the





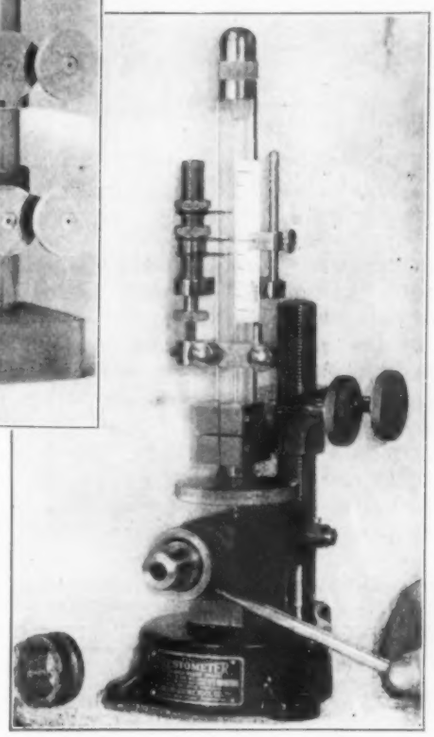


FIG. 1 (RIGHT). ATTACHMENT FOR GAGING BALL RACES

FIG. 2 (LEFT). ATTACHMENT FOR GAGING PISTONS

FIG. 3 (CENTER). ATTACHMENT FOR GAGING PINION-SHAFT HOUSINGS

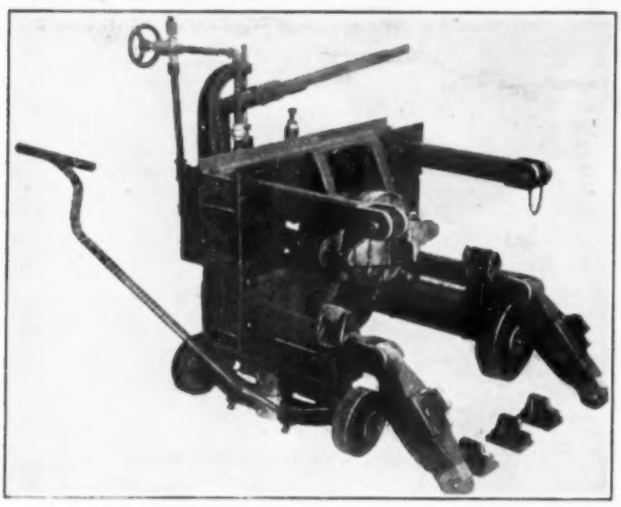
lands of the piston which are smaller in diameter than the body. In gaging, the piston should be located with the pin holes horizontal and the piston should be pushed longitudinally between the gaging contact and the anvil. The special scale will then show the correctness or variation from standard of the parts indicated thereon, the single pointer showing the normal height of the liquid. It is claimed that all parts of the piston, as indicated on the scale, can be gaged in one-quarter of a minute.

The attachment shown in Fig. 3 is intended for gaging pinion-shaft housings. This attachment is provided with two contact points, each of which is connected by a floating lever to the contact point of the instrument. The advantage of this arrangement is that it enables internal gaging to be done in a manner that has probably not been before attempted, in that internal stepped diameters can be accurately gaged even though they are not concentric either with each other or with the outside of the work.

In some cases it might be easier to support the work in V-blocks, but in this instance the outside diameter of the work was not the same throughout its length.

Hydraulic Rail-Bending Press

The accompanying illustration shows a hydraulic rail-bending press recently designed and built by the Hydraulic Press Manufacturing Co., of Mount Gilead, Ohio. The press is of 35-ton pressure capacity. It is of



HYDRAULIC RAIL-BENDING PRESS

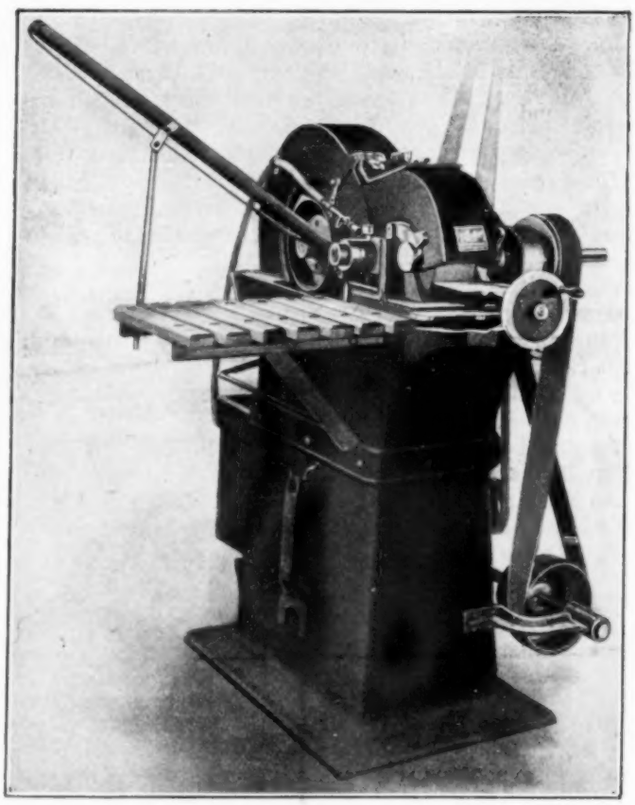
the horizontal type and mounted on wheels so that it can readily be moved and adjusted to the work. It is claimed that while the construction is comparatively light the machine is exceedingly rigid and ample in strength for the severest service that is likely to be required of it. Four cast-steel strain rods are rigidly attached to the double I-beams and are formed like clevises at their outer ends. Steel hinge pins at the bottom and steel locking pins at the top provide for connecting the two steel resistance heads when bending a rail. Each of the bottom strain rods has a steel roller mounted in such a way that when a rail is in the press it may be easily moved to apply the pressure at different points.

This press is fitted with a hand pump, spring relief valve, and a by-pass valve. The pump may be used for either high or low pressure. The low pressure may be used until the bending block meets the rail and the operator cannot operate the pump; then the high pressure is used.

The bypass valve is closed when the pressure is applied, and opened when the pressure is to be released. The spring pull-back device inclosed in the two small side cylinders returns the ram to its initial position.

Sanford Precision Centerless Grinding Machine

Russell, Holbrook & Henderson, Inc., 30 Church St., New York, has put on the market the centerless grinding machine shown in the illustration. This machine is intended for the precision grinding of rolls and other work having one diameter. In general, it consists of a grinding wheel to which is opposed a feed wheel of smaller diameter and inclined at an angle that may be



SANFORD PRECISION CENTERLESS GRINDING MACHINE

Capacity, 6 in. in diameter. Weight, net, 950 lb.; crated, 1,075 lb.; boxed for export, 1,500 lb. Floor space, 50 x 28 in. Height, 50 in. Grinding wheel, 20 x 3 in. Feed wheel, 10 x 3 in.

varied to suit the determined amount the work is to be fed past the grinding wheel. Ways for guiding the work are located between the grinding and feed wheels.

The carriage on which the feed wheel is mounted has provisions for adjustment due to wear. Its movement is by a screw having a micrometer head. Between the screw and the carriage there is a heavy spiral spring to provide a cushion which makes possible heavy cuts and fine finish. The rest which supports the work while being ground is a hardened round rod of a less diameter than the work and set below the centers of the wheels. The work being held between three almost equidistant points can not "whip" or jump and can only move endwise as directed by the feed wheel. The rod is supported at both ends of the carriage by special clamping nuts which also carry the guide for positioning

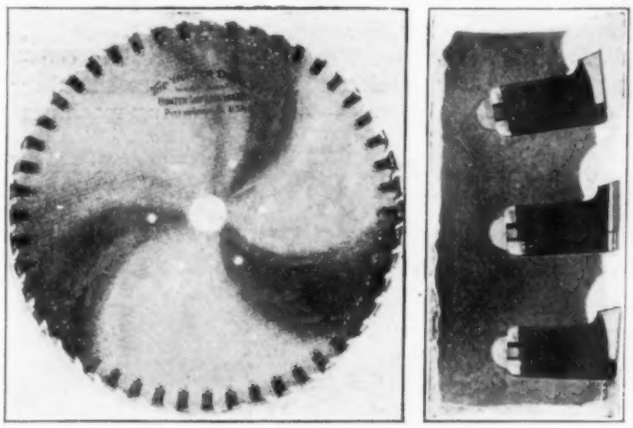
the work and carrying it directly to the grinding wheel.

The two diamonds are so mounted and the diamond holder is so arranged that the faces of both wheels can be turned at once. The drive is from a countershaft having a cone pulley so that the speed of the grinding wheel can be increased when worn. An arrangement of belts and worm gearing provides a reduction of speed for the feed wheel and a quick shift to high speed when this wheel is to be tried.

A feed chute is provided in which the work is placed and from which it is fed by gravity. The regular equipment includes two grinding wheels, one feed wheel, pump, tank, piping, countershaft, feed chute and all necessary wrenches. This machine is built by F. C. Sanford Manufacturing Co., Bridgeport, Conn.

Hunter Inserted-Tooth Saw

The inserted-tooth metal-cutting saw illustrated is a recent development of the Hunter Saw and Machine Co., Pittsburgh, Pa. The method used to fix the tooth in place employs a nut, screw and wedge arrangement. The half-round nut is fitted into a circular pocket at the bottom of the slot with a tongued and grooved joint to prevent side movement. The screw passes through the nut into a clearance hole drilled into the body of the saw. The tooth rests upon the hexagon head of the

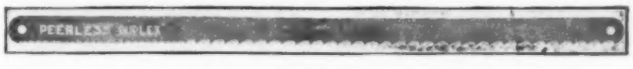


HUNTER INSERTED-TOOTH SAW

screw and when adjusted is locked in position by the wedge. The wedge and tooth are also tongued and grooved on both sides to prevent side slip. Independent screw adjustment is provided for each tooth. The saw teeth are alternately round and square nose. The round-nose teeth, being slightly higher than the square, act as leaders. The body of the saw blade is made of a tough, hard, oil-treated steel. The teeth are made from high-speed steel and the screws are heat treated.

Peerless Duplex Saw Blade

The hacksaw blade illustrated is a product of the Peerless Machine Co., Racine, Wis. The fine teeth at the toe of the blade are provided to start the cut, preparing the way for the faster-cutting teeth which follow. In hand sawing it is sometimes customary to start the cut with a file or by drawing the blade back-

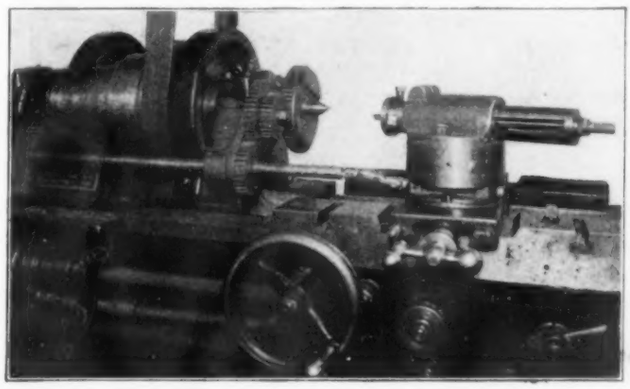


PEERLESS DUPLEX SAW BLADE

ward across the work, a practice which dulls the blade very quickly. Coarse teeth will sometimes hog into the work when starting a cut or jump sideways, particularly when working across corners. The Duplex blade is said to start the cut smoothly. It is made in 16—32-in. pitch, in 10- and 12-in. lengths only. Blades are made either of tungsten steel hard all over or of carbon steel with flexible backs.

"Fullswing" Relieving Attachment

The relieving attachment illustrated herewith is manufactured by W. D. Jones, 1010 Wilder Building, Rochester, N. Y. This attachment is said to be capable of relieving work internally, externally, or on the face



"FULLSWING" RELIEVING ATTACHMENT

either straight or at an angle. Cams with one, two, three or four steps, giving a standard relief of $\frac{1}{16}$ in., are furnished. These four cams will, in connection with the proper change gears, relieve work having from 2 to 28 flutes with the exception of 11, 13, 17 and 23. A vertical adjustment of $\frac{3}{8}$ in. is provided for the tool. This device will work in connection with the lathe taper-attachment and is regularly made to fit 13,- 16- and 18-in. lathes having compound rests. It can be furnished on order for 24- and 30-in. lathes.

Efficiency Pipe Wrench

The pipe wrench shown is manufactured by the Efficiency Device Corporation, 199 Eighth St., Long Island City, N. Y. The jaws are automatically closed by a spring inside the body of the wrench. The wrench is made in two sizes and styles, with teeth and without teeth, the latter being used for finished pipe. The grip is said to be positive for all working conditions of pipe fitting. The No. 10 wrench is used for pipe sizes ranging from $\frac{1}{8}$ to $\frac{3}{4}$ in. For the larger sizes ranging from 1 to $1\frac{1}{2}$ in. the No. 11 is used.

EFFICIENCY PIPE WRENCH

"Kavle" Correct Involute Contour Indicator

The contour indicator illustrated in Figs. 1 and 2 is being marketed by the Manufacturers' Consulting Engineers, McCarthy Bldg., Syracuse, N. Y. It is used to test the accuracy of the form of gear teeth. Its operation employs the same principle as used in laying out a true involute tooth form.

The indicator consists of a base plate, a plug of the same diameter of the base circle of the gear to be indicated, a plug or bushing to locate the gear and a straight-edge which is held in contact with the base

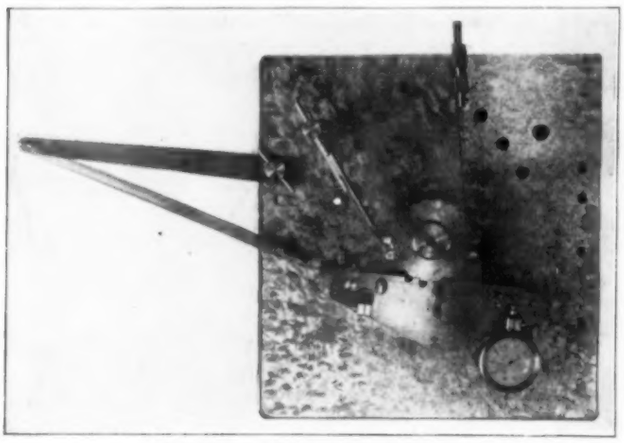


FIG. 1. "KAVLE" CORRECT INVOLUTE INDICATOR

circle plug by means of a steel ribbon, 0.002 in. in thickness, and a spring.

On the straight-edge is mounted a five-to-one lever, the short arm of which is in contact with the tooth form to be indicated, while the long arm is in contact with the plunger of an Ames indicator. The five-to-one lever multiplies the reading so that one mark on the indicator gives a reading of 0.0002 inch.

As the straight-edge is rolled about the base circle plug, the short arm follows the tooth form while the long arm remains in contact with the indicator plunger. If the tooth is of true form the pointer will not move. If the tooth is not of true form the indicator will show any deviation from within 0.0002 of an inch.

The indexing of the teeth may be indicated to the same degree of accuracy by means of the spring stop together with the indicator reading.

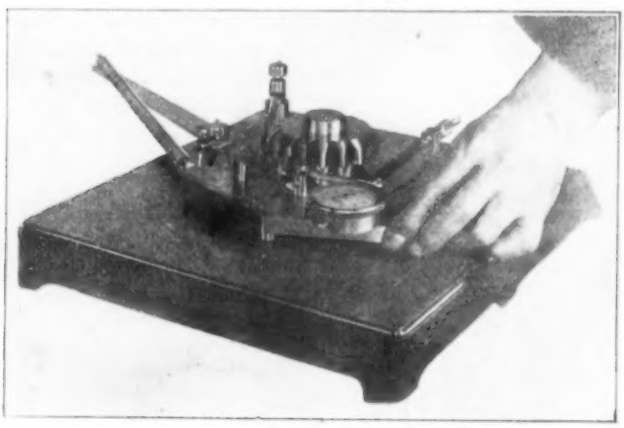


FIG. 2. TESTING A GEAR WITH THE "KAVLE" CORRECT INVOLUTE INDICATOR

Bush Safety Cartridge Fuse Remover

The tool shown is manufactured by the Bush Electric Co., Cleveland, Ohio, and is used for removing and replacing cartridge fuses from ½ to 1½-in. in diameter. It is made entirely of a special insulating compound, the parts being held together with small rivets. The small

BUSH FUSE REMOVER

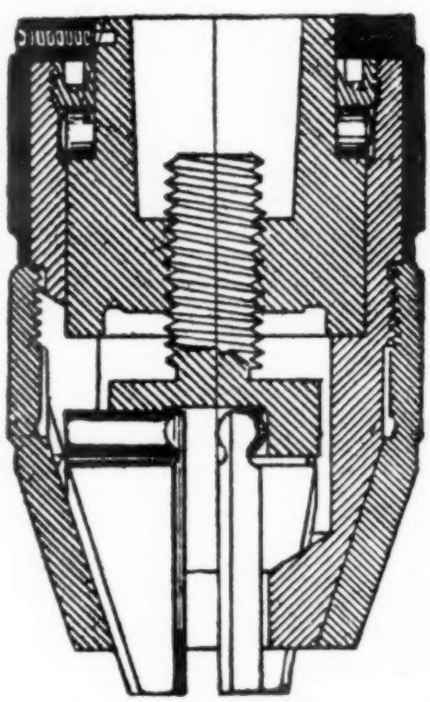
movement of the handles as compared with the large movement of the gripping jaws makes the tool very simple to operate, and useful when working around live circuits.

Eclipse Drill Chuck

The improved drill chuck shown in the illustration is made by the Nielson-Barton Chuck Co., 106 South Jefferson St., Chicago, Ill.

It is designed for hand operation only and is especially suitable for machines that have free running spindles, such as high-speed sensitive drilling machines and portable electric drills.

Two knurled collars are provided as grips for operating the chuck, one for each hand. As the gripping

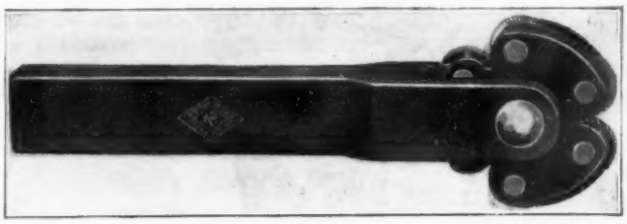


ECLIPSE DRILL CHUCK

power is augmented by the use of differential screws and the thrust is taken by a roller bearing it is not necessary to use a key or wrench in tightening the drill.

"New Britain" Knurling Tool

The New Britain Tool and Manufacturing Co., New Britain, Conn., has added to its line the multiple knurling tool shown in the cut. Each tool carries three pair



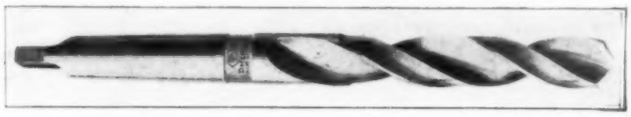
NEW BRITAIN KNURLING TOOL

of knurls for fine, medium or coarse knurling, and does away with the necessity for changing knurls.

The holder is drop-forged and case-hardened, the knurls are mill-cut. The tool is made in two sizes: $\frac{7}{8} \times \frac{1}{2} \times 6\frac{1}{2}$ and $1 \times \frac{1}{2} \times 6\frac{1}{2}$ in., the knurls being $\frac{3}{4}$ in. in diameter in each case and with a face width of $\frac{3}{16}$ and $\frac{3}{4}$ in. respectively.

Detroit Double "D" Drill

The drill shown is made from steel high in tungsten and chromium by the hot-rolled process, and is a product of the Detroit Twist Drill Co., Detroit, Mich. The flutes are formed straight by successive passes through special rolls at a temperature of 1,850 deg. F. The rolling



DETROIT DOUBLE "D" DRILL

process is said to refine the grain and produce a compression at the outer edges. The fluted blank is then reheated and twisted in a specially designed automatic machine.

The design of the drill with its wide flutes and 32-deg. helix angle is said to specially adapt it for deep drilling in tough or hard heat-treated material.

March Meeting of the American Steel Treaters' Society

An interesting address was delivered by Major A. E. Bellis, of the Springfield Armory, in the Auditorium of the Bush Terminal Sales Building on West 42nd St., before a comfortable audience composed of members and friends of the New York Chapter of the American Steel Treaters' Society, on the evening of Wednesday, March 17.

The subject of Major Bellis' address was Tool Hardening, with especial reference to the treating of high-speed steel to be used for cutting tools, and comparison of this material with carbon steels used for the same purpose.

The keynote of the speaker's talk was uniformity of conditions in heat treating. "There are," the Major said, "two hundred variables; two hundred excuses that the heat treater can put forward to explain a failure, and the only hope of getting a line on any one kind of high-speed steel is to handle it under absolutely uniform conditions so far as these latter are under the control of the treater, changing but one condition at a time, when conducting experiments and noting carefully the effect of one change before proceeding to another."

Major Bellis described the equipment in use at the Springfield Armory during the war, and told as one result of the laboratory experiments in treating high-speed steel how the record of five rifle barrels drilled to one grinding of the drill was raised to 36 barrels per grind with the same drill.

The speaker recommended the use of carbon steels for finishing reamers and similar tools which have comparatively light duty and depend upon their keen cutting edges for maintenance of size, and concluded with the sound advice "Don't use high-speed tools unless you have a high-speed job."

More About That Section Lining Kink

BY HENRY R. BOWMAN

I notice on page 204 of *American Machinist* an article by Geo. W. Childs in which he criticizes the use of a section liner. I would like to say that where any considerable amount of hatching is to be done such a device will cut down the time by fifty per cent.

There is one on the market that sells for about two dollars and it is all that can be desired. I have used it on Patent Office drawings requiring twenty lines to the inch; in book illustrating; and in Government work.

In hatching for steel, where there are two lines close together and then a wider space, I use a railroad

pen for the double line and set the section liner fc the wide space.

I think I can qualify as a practical draftsman according to Mr. Child's standard. I have had over ten years' drafting practice; I smoke, drink (used to before last July), cuss when occasion requires, and have some designs to my credit that are actually running.

Sparks from the World's

The Second Annual New York Aëro Show

The Second Annual New York Aëronautical Show under the auspices of the Manufacturers' Aircraft Association, Inc., was held at the 71st Regiment Armory, New York City from March 6 to 13. While not so large as its predecessor it was totally different in many respects and was quite successful from the standpoint of the exhibitors.

Unlike all former aëro shows, this one had no military planes or equipment on exhibition. The past year has been one of transition in the industry and the change from military to civil airplanes has been most complete. The only reminder of war in the whole show was a motor in the Wright-Hispano exhibit which was constructed with a 37-mm. cannon mounted to shoot through its propeller hub.

The most noticeable feature of the show was the tendency toward personal comfort for the passengers and simplicity and ease of operation for the pilot. Structural refinement developed by the war was evident on all machines, but the fundamental design of most of the planes did not resemble the standard military types. Much thought has been devoted to making flying enjoyable as well as safe, and because of this many departures from old practice were shown. The upholstery of many of the planes resembled that of high-grade motor cars and all four of the inclosed fuselages exhibited were finished in soft and luxurious tapestries.

A number of new motors were on view and showed many interesting developments. A tendency toward smaller motors of low power was in evidence and the radial motor monopolized this field quite thoroughly. The Cato motor, with two opposed cylinders, developing 72 horsepower, and the Lawrence three-cylinder radial motor rated at 60 horsepower, were good examples from a standpoint of development and construction in this class. An airplane engine exhibited by E. L. Beecher attracted considerable notice. It was an eight-cylinder motor with opposed cylinders.

The Hall-Scott Motor Co. had an exhibit of six-cylinder motors, which followed the general design of the Liberty motor and used many of its parts, including the cylinders, valve mechanism and pistons. The Curtiss, Aëromarine and Packard motors were shown and each made an interesting exhibit. For the first time, Liberty motors were actually placed on sale in competition with other motors.

More attention was paid to instruments than in previous years, and most of the planes were well equipped with them. Practically every airplane in the show had a compass in its equipment, and running lights on the wing tips and tails were also prevalent. The Pioneer Instrument Co. had its products in working order and attracted much attention. A realization of the need of good instruments on the part of fliers was apparent.

Three of the largest types of mail planes were exhibited: the Martin (in model form), the L. W. F. and the Thomas-Morse. The L. W. F. machine was by far the biggest machine in the show. It had a wing spread of 105 ft. and was equipped with three Liberty motors. The Thomas-Morse plane with a wing spread of 45 ft. was equipped with two 300-hp. Wright-Hispano motors mounted in tandem and had a useful load of 2,610 pounds.

A "Pony Blimp" exhibited by Goodyear was the first lighter-than-air machine to be offered to the public for sport purposes. It was 95 ft. long with a maximum diameter of 28 ft., and was propelled by a 40-hp. water-cooled motor.

Interesting exhibits of instruments and unusual airplane equipment were shown in exhibits of the Army, Navy and Bureau of Standards. The latter exhibit consisted mostly of instruments taken from captured German airplanes.

The increase in public interest in the airplane industry was shown in numerous ways and, as a result, many new aircraft publications have come into the field. Many demobilized Army and Navy fliers attended the show and their general attitude was that they wanted to get back into the flying game as soon as they could find an opening. The recent war caused many people to become interested in aviation in at least a general way and this interest was reflected during the show by the knowledge of the general public of things aëronautical.

The following is a list of the exhibitors as given in the official program: Aircraft—Aëromarine Plane and Motor Co.; Curtiss Aëroplane and Motor Corporation; Gallaudet Aircraft Corporation; General Motors Corporation, Dayton-Wright Division; Goodyear Tire and Rubber Co.; L. W. F. Engineering Corporation; Glenn L. Martin Co.; Ordnance Engineering Co.; Stinson Aëroplane Co.; Thomas-Morse Aircraft Corporation; West Virginia Aircraft Co. Engines—Aëromarine Plane and Motor Co.; Curtiss Aëroplane and Motor Corporation; Hall-Scott Motor Co.; Lawrence Aëro Engine Corporation; L. W. F. Engineering Corporation; Packard Motor Car Co.; Wright Aëronautical Corporation.

Government Exhibits—U. S. Army Aviation, U. S. Navy Aviation, Army and Navy Radio, Bureau of Standards.

Instruments—Pioneer Instrument Co., S. Smith and Sons Co.

War Department Not Connected With French Negotiations

In connection with the orders for machine tools being placed in this country by the French and Belgian commissions, it is pointed out at the office of the Director of Sales that the War Department is in no way connected with the negotiations which are taking place between these commissions and private manufacturers. Some manufacturers are under the impression that because the French have been extended credit to make their purchases of machine tools, private credits can be arranged through the War Department. This is not the case. The War Department simply agreed to allow the French to have such surplus tools as they might desire, on credit. While the Director of Sales is anxious to be of service to American manufacturers and to the French Commission in assisting the French to round out their needs, the private purchases of the Commission are in no way being financed by the Government.

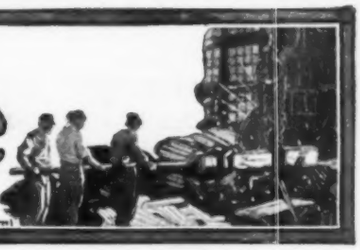
Since the French Commission has been in the United States machine tools have been accepted to the extent of one million dollars. Much heavier purchases are expected to follow promptly. The Commission was somewhat disappointed by the results of its trip in the West as few tools suited to its needs were found. The trip to Bridgeport and to the Watervliet arsenal, on the other hand, were very successful. Practically all the machine tools available at those points were accepted by the Commission. The next trip will be to inspect stores of tools at Rochester, N. Y., Springfield, Mass., and Boston. St. Louis interests are extending an urgent invitation to the Commission to visit that city where considerable quantities of tools are available.

All of the War Department's sales to the Commission have been at domestic prices. The French are paying for crating, loading and transportation to the seaboard.

Barber-Colman Co.'s Clubs

The Barber-Colman Co., of Rockford, is taking delight in providing for the welfare and recreation of its employees. A mutual benefit department, bowling leagues, a gun club, a crack band and a girls' club are among the more prominent bodies within the B-C group. Easy banking facilities are also provided through a special arrangement by the Barber-Colman Association office.

Industrial Forge



Carl F. Deitz Reports on the European Situation

Carl F. Deitz, vice president and general sales manager of the Norton Co., had unusual opportunity to study industrial conditions abroad during his recent European trip, for he came into intimate contact with manufacturers of Great Britain, France, Germany, Holland and Belgium and, to some extent, with those of the Skandinavian countries. He returns to America convinced that in a relatively short time the American market will be seriously influenced by the flood of manufactured goods produced in European mills, basing his opinion on what the manufacturers across the water are doing in the way of preparations.

The Europeans have learned a lesson from the war, said Mr. Deitz. They found that they could not depend upon their own resources, that when they came face to face with the emergency they must turn to America. They realized at last in spite of the discrepancy of wages existing in their favor American mass production methods must always get the upper hand. Now the European manufacturers are saying that "if America could do these things with her tremendously high wages, think what we can do with the same methods and cheap labor!"

Consequently, continued Mr. Deitz, Europe is abandoning its hit or miss methods and will specialize. With specialized labor-saving tools and the methods employed in this country—and some of the best American brains are going with the foreign manufacturers to develop this idea—production per hour per man will get higher and higher.

However, the threat of European invasion is not for the immediate present. The handicap of raw materials is too great, and prices abroad, especially in Great Britain, are tremendously high. But later, perhaps, by two years from now, when industry over there has adjusted itself and the producers both of raw materials and of finished products are on their feet again, the invasion of America will begin.

Mr. Deitz expects that European machine-tool builders will become important factors in the American trade. One well-known British distributor said to him: "You have come into our market and competed. Why should we not go into your market?" They are making very good machines abroad, said Mr. Deitz, some of them perhaps not so good as the American tools, but good machines none the less, and with quantity production the Europeans should be formidable competitors here. The higher the grade of American machine the less the competition will be. The better the methods and better the designs of machines made abroad, the greater the hold that the foreign builder will have on his home market. This is also true of German and French machinery. Thus, American export trade will be affected.

The British are tremendously aggressive at this time in developing their foreign markets. They have agents all over the world preparing to undertake a vast business. They are getting in touch with prospective customers, putting them on their feet when necessary, and closest co-operation is being developed between the mother country and her colonies, that business which one cannot handle may be diverted to other British dominions. An important influence in developing this foreign trade lies in the associations organized for the purpose, each for its own industry as, for example, the Association of British Machine Tool Builders.

The Stanley Works Merger

The latest step in the merger of the Stanley Rule and Level Co. and the Stanley Works, both of New Haven, Conn., was a meeting held recently by the respective directorates who went over the outlines of the plan for the culmination of the deal. The directors of the Stanley Works compiled a statement for the stockholders which set forth the proposition to make the purchase and explained how it will work out.

The directors of the Stanley Rule and Level Co. received the outline and prepared a statement for the stockholders setting forth the terms of the purchase and the plan for the sale. The meetings of the stockholders will follow shortly. In view of the proposed merger there is considerable interest in the out-of-town concerns of the Stanley Rule and Level Co. which are as follows: The Roxton Pond plant where the Canadian plant of the Stanley Rule and Level Co. is located; the Roxton Tool and Mill Co. which now employs sixty people; the Plantsville shop which manufactures small tools; the Atha Tool Co., of Newark, N. J., the largest branch of the company, where 400 people are employed; the John S. Fray Co. which manufactures bits, etc.; and the Eagle Square Manufacturing Co., of South Shaftsbury, Vermont.

An Amendment Adopted To Keep the Arsenals Going

During the consideration of the Army Reorganization Bill, the House adopted an amendment directing the Secretary of War to cause to be manufactured or produced at the Government arsenals, and at Government-owned factories, all such supplies needed by the War Department as such plants are capable of producing. A proviso makes it mandatory that the cost of these supplies shall not exceed the cost if purchased in the open market. It is also provided that materials produced at these Government plants must meet the same tests and requirements as materials purchased from private manufacturers.

In urging the acceptance of the amendment, Representative Sanford of New York made the following statement:

"The Government has invested at Watervliet over $20,000,000; there is employed there at this time a force of highly trained mechanics gathered together from all parts of the country to meet the emergency created by the war. The arsenal is now equipped to do work of the finest grade involving that most intricate of all machine work necessary to produce modern cannon. There are about 2,500 men employed there at this time, a large part of whom the Government plans to discharge in the near future.

"I assure you that this plant can do as high-grade machine-shop work as the Bethlehem Steel Co. or any other private concern.

"The purpose of this amendment is to compel the executive officers of the Government to have Government work done at such arsenals as this and to cease handing out appropriations to private manufacturers. It is perfect nonsense to allow such an investment as this to go to waste and at the same time turn over work to be done by contract by private manufacturers.

"Unfortunately under the provisions of the general law appropriations of money for work to be done in a Government plant lapses at the end of the fiscal year for which the appropriation is made. This amendment removes this restriction and continues the appropriation for an additional year. This limitation of law has often compelled the Ordnance Department to turn work over to private manufacturers."

"When a man tells you that you can live without working, ask him where he gets his."—*Industry.*

Trade Letter from Our London Correspondent

London, March 5th, 1920.

The three British Industries Fairs held in London, Glasgow and Birmingham close today. It is too early to give an exact idea as to the volume of business transacted, but according to official statements heavy orders have been received from the United States and from Holland, Switzerland and Spain; also from Scandinavia. In fact, outside of late enemies, all the countries of Europe, new and old, have one way or another been mentioned in connection with business transacted, while buyers have given orders from Japan, Burma and Iceland; this apart from the British dominions and colonies, in connection with which Canada has been specially noted.

In Birmingham, toolmakers seem to be rather disappointed. However, in the engineering trades, inquiry for special tools has been satisfactory, while business is expected to follow from the many inquiries relating to foundry plants. The inquiries seem to be mainly British, though a few of the European countries are known to be seeking new equipment.

At the last meeting of the London Iron and Steel Exchange the most noteworthy feature seemed to be the absence of sellers. Apparently, an advance in rates has been decided on but not the extent. Meanwhile, a report from Yorkshire shows that the price of steel billets is now more than £20 a ton, or between three or four times the pre-war price. Despite this, orders pour into Sheffield, where a steel famine is regarded by some authorities as not far distant. The sales to America of high-speed steels have improved, and tool-steel price advances have been effected as follows: From March 1, 3s. 2d. for 14 per cent tungsten qualities, to 3s. 9d. for better qualities. The reasons stated are both increased cost of production and the great demand. Special steels have been in request, but according to a local report the makers can cope with the call. In the Birmingham district 5s. a ton has been added to the price of coke and the probability is that pig iron will be raised by 10s., this being based on 1½ ton of coke to 1 ton of pig iron, with allowance for the extra amount of moisture in coke as now supplied.

Complaints are prevalent as to the lower rates of production now obtained from all classes of workers. Some evidence on this point was given recently at the Law Courts, London, W. C., during the course of the inquiry on the minimum wage demand by dock workers. One witness from Glasgow stated that the rate of discharge on ore is now 21 tons an hour, as compared with 29.6 tons in 1913 and 64 tons in the middle of 1918. The explanation of the latter figure is that at the request of the Ministry of Munitions piece-work was introduced as a war measure, while last year there was a reversion to time work. Not only had the output decreased by 66 per cent, but the number of men employed had been increased in the ratio of 15 to 19.

Among firms that, as a result of the demand during and following the war, are extending their facilities for the production of smaller articles in the equipment of the machine shops is B. S. A. Tools, Ltd., really a section of the well-known Birmingham organization, with which the Daimler and a number of other companies are associated. The firm of Burton, Griffiths & Co., Ltd., a subsidiary company, is the distributor. Recently, the engineering press of Great Britain was invited to inspect the shops of the small-tool side and were entertained at luncheon.

The B. S. A. have four factories, three in the Birmingham area; namely, at Small Heath, Sparkbrook and one on a Coventry Road site, with another factory at Redditch.

William L. Kaiser Promoted

William L. Kaiser, for the past four years sales manager for the Sumter Division, Splitdorf Electrical Co., Chicago, has been promoted to the position of general sales manager. His many friends will receive the announcement as good news. Mr. Kaiser holds the respect and love of every member of the Splitdorf organization and is generally known as "Bill."

Previous to his connection with the Splitdorf company, he spent a number of years on the road as sales engineer for other manufacturers of magnetos and ignition specialties, and through

these years of constant work has become very widely acquainted in the tractor, truck and farm-engine fields.

This change does not mean that Mr. Kaiser will be off the road, but necessity will confine him to fewer calls. He expects to multiply his own ideas and methods through the salesmen working under his direction.

Maryland Company Takes Over Black & Decker Plant

The Dieffenbach-Westendorf Manufacturing Co. has been incorporated under the laws of Maryland with $80,000 capital stock divided into 800 shares, and has taken over the special machinery department formerly used by the Black & Decker Manufacturing Co., 105-115 South Calvert St., Baltimore, Md. The last-named company recently moved into larger quarters at Towson, Md. The equipment which was used was left at the old building and this, too, has been taken over by the new corporation.

The company will continue using the plant for the manufacture of special machinery of all kinds. The incorporators are Otto W. Dieffenbach, who was secretary of the Black & Decker Co.; John W. Westendorf, who was shop superintendent for the company, and George M. Kimberly, who will continue as treasurer of the Black & Decker Co. and fill the same office with the new company.

This firm manufactures standard twist drills in high-speed steel up to 3-in. diameter, milling cutters, reamers, slitting saws, gages of all types, taps and dies, jigs, fixtures and special machines. The firm proposes, in fact, to act as consultants in the engineering workshop equipment, advising, if necessary, on the layout of a plant for a given product in quantities; supplying machines and small tools needed, and planning operations.

During the war girls formed about one-third of the personnel employed in the company's shops. To judge by inspection their numbers have been considerably reduced. The weekly output then averaged about 15,000 cutters of all kinds, about 1,000 jigs and fixtures, some 800 gages and 40,000 drills of various sizes, the last without reference to drills supplied for the firm's own works. As to the production of machine tools, special spline milling machines for finishing the fins on the Bentley rotary airplane-engine cylinder head are mentioned. For this purpose, as soon as the demand was evident, designs were made, patterns of castings obtained and the first four machines were built in eight weeks, the total of fifty-eight eventually being produced, so that at the time of the armistice the weekly output was some 2,000 heads, each of which, it may be mentioned incidentally, passed through 75 operations. The plant at Sparkbrook includes about 2,000 machine tools, chiefly American, including Hendy, Brown & Sharpe, Gisholt, Cincinnati, Cleveland, Greenfield and Herbert & Churchill productions.

Small-Arms Plant for Chile

Ambassador Joseph H. Shea has cabled from Santiago that the Chilean Government has contracted with the Niles-Bement-Pond Co., an Ameriacn corporation, for the construction of a small-arms factory.

Rockford Machine-Tool Companies in Good Condition

The situation in the Rockford, Ill., machine-tool factories never presented a rosier aspect than it does today, at least with respect to volume of business in hand and in sight.

Some difficulty is being experienced in securing sufficient material, and just the right kind of help, but the factories are taking these small hurdles in as cheerful a manner as possible and are going ahead with the object of turning out just as large a volume of goods with the forces in hand as is possible.

A recent epidemic of influenza seriously handicapped the Rockford concerns while it lasted, and the effects of the renewal of the "flu" have not been fully dissipated. In a number of the factories the working forces were cut down 20 per cent while the epidemic was at its height.

Many of the factories are greatly pressed for room in which to take care of the expanding business, both domestic and foreign. Buildings now under way will increase the capacity of a number of the concerns this spring and by summer the Rockford factories will be in a position to give improved service in delivery almost in every line.

Among the concerns which will profit by additional floor space this spring will be the Ingersoll Milling Machine Co., Anderson Brothers Manufacturing Co., Mechanics Machine Co., Barber-Colman Co. and Eclipse Fuel Engineering Co.

General Electric Leases Remington War Plant

The great munition plant that the Remington Arms U. M. C. Co. constructed at Brideport during the war has been taken over under lease by the General Electric Co., with the option to purchase, Joseph P. Day, who engineered the transaction, announced recently. More than $7,000,000 was involved in the deal.

The factory is probably the largest of its kind in the country. It was built purely for the filling of war orders, and the normal work of the Remington Co. will still be carried on in its long-established Bridgeport plant.

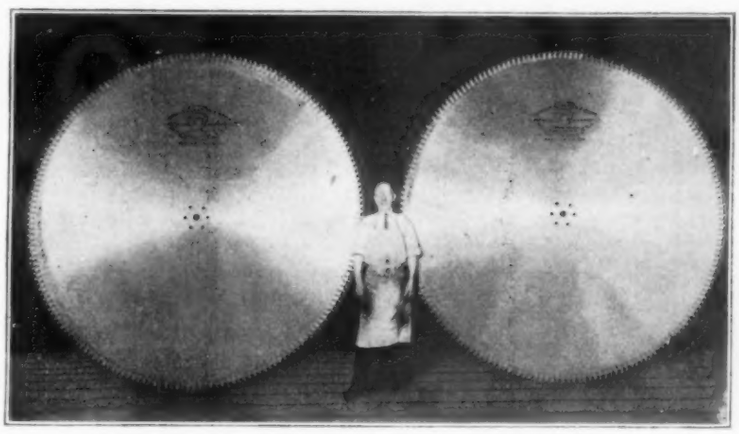
Covering a tract of about forty acres, the General Electric Co.'s new structure affords actual floor area of 1,555,257 sq.ft. When in full operation it will employ several thousand workers.

C. L. Reierson, president of the Remington Arms Co., said: "The plant that has just been taken over by the General Electric Co. was one of our surplus properties. The leasing of this property has no effect whatsoever on our U. M. C. plant at Bridgeport."

Two Large Saws for Western Forests

Henry Disston & Sons, Inc., of Philadelphia, have recently finished two of the largest circular saws ever made. They are of the spiral inserted-tooth type, and are to be used by a well-known concern in the West for cutting shingle blocks from the large trees of that section.

Each of the new saws measures 108 in. in diameter, and 190 teeth are inserted in the rim. One may gain some idea of the size of the new saw by comparing it with a 54-in. saw, which is large as we ordinarily think of the term. The 54-in. saw requires for its making an ingot of steel weighing approximately 180 lb. and its weight when finished is about 125 lb. The 108-in. saw started out as an ingot weighing 1,140 lb.; and, after reheating, rolling and trimming, the remaining weight was about 795 lb. In size, a 54-in. saw is apparently just half that of the 108-in. one, but actually the 108-in. is four times the size of the former.



In the making of large circular saws, Henry Disston & Sons have had long experience. As long ago as 1876 they made one 100 in. in diameter for exhibition purposes. Some years after they made another 100-in. saw for cutting stone, each tooth of which was studded with a black diamond to give the necessary cutting edge.

The turning out of a huge saw is a difficult process when one realizes that the ingot must be not only fashioned into a plate exactly straight and true, but also that the steel must be uniform in quality throughout the entire surface. Such are the facilities and improvements at the Disston Works that the standard machinery was used throughout. All that was needed in addition was extra man power as "holders-up" during the smithing process.

To fully appreciate one of these immense saws, one must see it in action. At full speed, the teeth are traveling about 130 miles an hour. It is then that the forcefulness of this flying mass of toothed steel becomes strikingly impressive, and the sight of this huge saw, resistlessly and quickly cutting an immense log, is long remembered.

Trade Currents from New York, Cleveland and Chicago

New York Letter

The machine-tool business for the past week showed a decided improvement over the week preceding, with all lines active. Deliveries show some indication of easing up, and one firm is quoting certain types of millers at 40 to 60 days, but, generally, delivery dates remain about the same as at last writing.

Grinding machines were in good demand on last week's inquiry lists. New England industries entered the New York market for all types, and prompted a statement by a leading firm that its New England grinding-machine business was much heavier today than on October 15 of last year when a high level of sales was reached.

Inquiries of late have been somewhat indefinite, being accompanied in many instances by statements that the inquirer "expects to be in the market within the next few months." There is, however, a substantial volume of inquiries that are being turned into orders. A fair volume of inquiries for estimating purposes is going through also.

Among the railroad buyers in the New York market last week were the Boston & Albany, Boston & Maine, Lehigh Valley, and the C. R.R. of N. J. It is reported that the lists have been completed, and that the roads mentioned are temporarily out of the market.

The Otis Elevator Co. issued a list during the past week of about fifteen items, and the Westinghouse Electric and Machine Co. has been inquiring for equipment to be used in its Springfield plant. The Port Wentworth Lumber Co., of Savannah, Ga., and the Stockham Pipe and Fitting Co., of Birmingham, Ala., were among the Southern interests represented in last week's business.

The Commercial Union of America reports a demand from its Levant houses for lathes, millers, automatic screw machines, and general machine-shop equipment.

Cleveland Letter

The northern Ohio machine-tool market closed the week steady with shapers leading the demand. A good volume of business was represented by drill presses, planers, and twist lathes.

Orders continued small, single-piece orders prevailing. Much of last week's business was placed by garages and repair shops, with general manufacturing buying lightly.

There is considerable inquiry from points outside of the Cleveland district proper, chiefly for used equipment.

Shop material most in demand is scarce, while lines in light demand are reported plentiful with spot delivery offered.

Some export business has been placed with Cleveland dealers during the past week, France, England, and several South American countries buying. Drill presses form the bulk of the business.

Chicago Letter

The last fortnight has witnessed a perceptible falling off in business. Dealers are a unit in stating that store trade, that is, buying by callers, has materially declined, and with one exception are agreed that inquiries and orders received through the mail are in lesser volume than has been the average for the past three or four months. This reduction is not so great as to cause any uneasiness, but is rather welcomed by all concerned. The volume of business remaining may be appreciated from the fact that all houses report all their salesmen busy on specific prospects.

The cause of this slackness is problematical. Many dealers believe it to be occasioned by difficulty in machinery users securing raw material. In some cases, when machines on back order have been ready for delivery, dealers have been requested to take them off the buyer's hands, as the purchaser was unable to secure materials with which to operate the equipment. In each case, a resale of the machine in question was easily made, as deliveries in all lines are still far behind. Other dealers believe high prices to be the cause. In view of the fact that prices in many other lines are showing a tendency to seek lower levels it may be that prospective purchasers feel like awaiting developments. With raw material conditions as they are, with labor still scarce and high priced, and with manufacturers booked solid for months to come, any anticipation of lower prices at present seems unfounded.

The future of railroad purchasing is a matter of much conjecture. It is fairly well understood that at least two of the great Western systems are preparing comprehensive lists of requirements. No requests for bids on specific items have as yet been received by the trade.

Government sale of equipment at the old Symington plant continues. There remains but little unsold. The St. Louis District Salvage Board is forwarding weekly bulletins of miscellaneous equipment offered for sale. The current list includes eight drill presses, nine screw machines, thirteen presses of various types and a number of lathes ranging in size from 24. in x 12 ft. to 27 in. x 14 ft. Tools will be sold to the "first bidder submitting price, considered, by the Government, to be a fair value."

Sales in Chicago district continue to be widely diversified in character and to come from all classes of industry. Buying by automobile manufacturers has been reduced to a very small item, but no other industry is conspicuous either as a heavy or light buyer. Deliveries are even worse than they have been. Three large dealers report that the volume of their deferred deliveries is increasing about $30,000 a month.

Short News Notes

The Alloy Electric Steel Casting Co. will erect a plant at Warren, Ohio, on a site secured by the Warren Chamber of Commerce.

It will manufacture a general line of auto parts, with a small casting foundry in connection.

N. L. Coxey is president; A. T. Ranck, vice president, and J. S. Coxey, Jr., secretary and treasurer.

* * *

The Cleveland Duplex Machinery Co. celebrated its second anniversay with a dinner and theater party.

President G. Jack Hamkey presided at the dinner, and headed the list of speakers, which included other officials of the company.

* * *

The Peck Spring Co., Plainville, Conn., has elected D. C. Peck, president and secretary, and D. K. Peck, treasurer and general manager of the concern, which was recently incorporated.

Soft Coal Output Gains

The weekly report on the production of coal, compiled by the Geological Survey Department of the Interior, shows an increase in the output of bituminous coal during the week ended March 6. The total output (including lignite and coal coked) is estimated at 10,352,000 tons, an increase over the preceding week of 207,000 tons, or 2 per cent.

Telegraphic reports received from two out of the nine anthracite carriers indicate a slight decline in production during the week ended March 6. No estimate of the total production can yet be made.

Obituary

Doctor A. L. Garver, member of the Industrial Board, was stricken with a cerebral hemorrhage on Tuesday, March 2, while on a business trip to Altoona and died almost immediately. Doctor Garver had been a member of the Industrial Board since Dec. 1, 1916, representing the employers of labor of the State of Pennsylvania.

Domestic Exports of Metal-Working Machinery from the United States by Countries During December, 1919

Countries	491 Lathes	492 Other Machine Tools	493 Sharpening and Grinding Machines	495 All Other
Austria-Hungary	$4,875	.....	.....	.....
Belgium	12,720	$14,449	$540	$49,012
Denmark	1,019	.....	4,489	2,330
France	136,419	191,095	63,908	572,351
Greece	.....	.....	17	.....
Italy	2,032	29,703	13,385	53,445
Netherlands	4,340	7,472	286	4,121
Norway	2,672	5,433	2,068	8,577
Portugal	.....	65	674	.....
Russia in Europe	6,765	5,148	.....	2,164
Spain	30,389	22,322	7,176	50,576
Sweden	15	137	233	.....
Switzerland	2,933	16,124	6,462	15,451
England	171,708	212,996	62,277	375,269
Scotland	.....	2,136	197	2,587
Canada	68,317	196,883	39,456	235,762
Costa Rica	.....	91	.....	.....
Guatemala	.....	.....	.....	199
Honduras	31	.....	200	.....
Nicaragua	.....	352	.....	1,260
Panama	939	660	.....	99
Salvador	795	.....	.....	270
Mexico	88,994	2,157	2,783	4,690
Newfoundland and Labrador	.....	1,023	.....	250
Jamaica	61	.....	.....	.....
Trinidad and Tobago	.....	76	.....	142
Other British West Indies	.....	.....	.....	2
Cuba	14,594	16,099	897	20,871
French West Indies	.....	60	.....	.....
Haiti	.....	17	.....	.....
Dominican Republic	90	45	.....	3,933
Argentina	12,245	3,208	378	23,174
Bolivia	.....	.....	14	.....
Brazil	5,844	1,569	1,021	5,719
Chile	4,408	17,716	3,423	45,925
Colombia	85	99	21	1,575
Ecuador	584	.....	.....	.....
British Guiana	.....	289	20	1,283
Peru	572	8,798	.....	12,342
Uruguay	27	1,063	.....	.....
Venezuela	.....	3,748	.....	1,230
China	.....	1,187	45	989
British India	5,891	12,623	12,476	133,203
Straits Settlements	.....	325	.....	.....
Dutch East Indies	130	4,315	1,106	4,750
Hongkong	.....	220	62	1,722
Japan	8,098	14,054	7,523	31,884
Siam	.....	87	.....	.....
Australia	9,524	31,557	9,848	33,054
New Zealand	3,787	1,197	2,752	490
Philippine Islands	1,201	1,709	300	1,139
British South Africa	3,815	8,637	705	13,930
French Africa	.....	246	.....	.....
Morocco	.....	27	121	98
Egypt	1,813	.....	.....	.....
Total	$607,732	$837,217	$244,863	$1,715,868

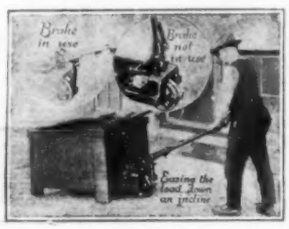
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Attachment, Transveyor Brake

Cowan Truck Co., Holyoke, Mass.

"American Machinist," March 4, 1920

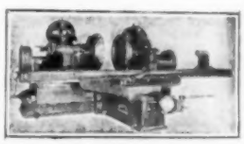


The brake shoe is normally held from contact with the wheel by a flat spring. A pendant hooked up to the tongue may be released and dropped into a notch in the lower part of the brake shoe. When in this position, pressing down on the tongue will apply the brake. The brake shoe is lined with raybestos.

Milling Machine, Crankshaft Cheek

Newton Machine Tool Works, Inc., Philadelphia, Pa.

"American Machinist," March 4, 1920



The centers for carrying the crankshaft are movable on the table to accommodate work of varying length. Suitable arch clamps furnished for holding work. The cutter bodies are steel castings having tool slots machined from the solid. Internal driving gears are integral parts of the cutter bodies. Cutters are driven by individual motors. Specifications: Maximum distance between centers, 15 ft.; swing, 22 in.; diameter of cutters, 40 in.; distance between cutters, minimum 4 in.; maximum 30 in.; number of feeds, six.

Toolpost, T. M. B. Double

Connery Machine and Tool Co., 56 Harrison Ave., Springfield, Mass.

"American Machinist," March 4, 1920

The broad, flat base and top clamp furnish a substantial means for holding two tools securely and at the same time absorbing much of the vibration. The combination of a convex washer and spring under the nut allows the equalizing clamp to adjust itself to tools of various sizes. A curved plate below the base permits the tool points to be raised or lowered in the usual manner. The bolt head is of irregular shape so as to be adaptable to different widths of slots.

Milling Machine, Automatic Thread

Automatic Machine Co., Bridgeport, Conn.

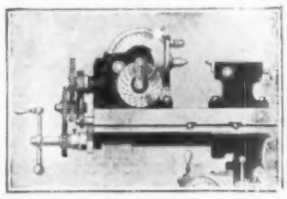
"American Machinist," March 4, 1920

Machine is of the hob type in which the cutter has the form of the thread to be cut but is without lead. Thread can be cut in one revolution of the work plus a slight overtravel. Both internal and external threads can be milled. Cutter and work spindles are driven by separate belts from same countershaft. Headstock can be swiveled on the bed so that taper threads can be milled. Specifications: Swing over bed, 14¼ in.; diameter of spindle face, 7⅝ in.; hole in spindle, 4⅜ in.; maximum distance between work and cutter spindles, 14 in.; hole in cutter spindle, No. 9 B. & S. taper; capacity, 6 in. in diameter; floor space, 50 x 24 in.; weight, net 2,000 lb., crated 2,200 lb., boxed for export, 2,525 lb.; dimensions of box, 72 x 56 x 30 in.

Dividing Head, Universal

Conradson Machine Tool Co., Chicago, Ill.

"American Machinist," March 4, 1920

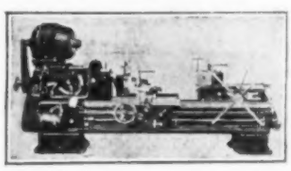


The faceplate has twenty-four holes for direct indexing and a ⅝ x ⅜-in. slot for the driving dog. The head is graduated and can be clamped in any position from 10 deg. below horizontal to 10 deg. beyond perpendicular. Regular equipment consists of three index plates that will divide all numbers up to fifty and many beyond, wrenches, bolts, driving dogs, and an index table giving all divisions up to 360. Swing, 14¾ in.; maximum distance between centers on Ryerson-Conradson No. 3 milling machine, 41 in.; combined length of headstock and tailstock, 24 11/16 in.; hole through spindle, 2 1/16 in.; taper hole in spindle, No. 14 B. & S.; faceplate, 8 in. in diameter; weight, 335 lb.

Lathe, Geared-Head Engine

Cincinnati Lathe and Tool Co., Cincinnati, Ohio

"American Machinist," March 4, 1920

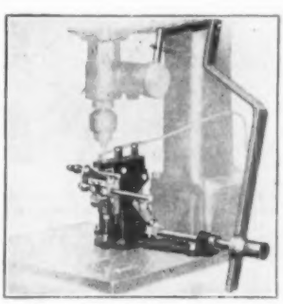


Lathe is built in seven sizes, from 16 to 28 in., and is furnished with either single-pulley drive, or motor drive through silent chain; also furnished as a manufacturing lathe, as shown, a power feed is supplied for the turret. Constant-speed motor is used, as all speed variation is obtainable through gears, which provide twelve speed changes in geometrical progression. Gears are positioned by three levers on the front of headstock and safety devices are not required. Any lever may be shifted without interfering with the others, and without any danger of locking the gears. A control is provided at the apron by which the spindle may be started, stopped or reversed while the power is on.

Jig, Adjusto Drilling

Automatic Drill Tool Co., 549 West Washington Blvd., Chicago

"American Machinist," March 4, 1920



Designed to speed production by automatically clamping and ejecting small pieces of work from the jig. The device can be set for various sizes of work and for different locations of holes, thus avoiding the building of special jigs for certain classes of work. The device can be easily attached to a high-speed sensitive drilling machine and can be adjusted to take parts up to 1 in. in diameter. It drills up to ½ in., and can be fitted with special holding blocks for odd-shaped pieces.

Testing Machine, 60-Ton Horizontal

W. & T. Avery Ltd., Soho, Birmingham, England

"American Machinist," (English Edition) Feb. 4, 1920

Machine, capable of testing hemp or wire ropes and also chain cables. Bar specimens of iron or steel may be tested to destruction and owing to the long length of tensile specimen which may be used, namely 6 ft., very useful data of material under test may be obtained. Machine has a hydraulic cylinder and a weighing system. Between these is the steel compression frame for receiving the strain. Hydraulic cylinder and ram are designed to give both slow straining speeds for testing stroke and a quick-return action. Pressure supply is derived from a Hele-Shaw pump driven direct by electric motor. Pump delivers oil under pressure to either end of cylinder, direction of the movement of ram, also the testing speed, entirely controlled by pump handwheel.

Clip, paste on 3 x 5-in. cards and file as desired

Business Items

The Van Norman Machine Tool Co., Springfield, Mass., has moved its New York office from 320 Fifth Ave. to Room 1856, 50 Church St., with J. D. Apgar in charge.

Charles A. Cook & Co., Inc., Brooklyn, N. Y., has had its name changed to the Reliance Spring and Manufacturing Co., Inc. It will continue to manufacture springs as heretofore.

Stockholders of the Four Wheel Drive Auto Co., Clintonville, Wis., have organized a $500,000 corporation to take over the Menominee Motor Truck Co., of Michigan. A new plant will be erected in this city.

At a recent special meeting of the stockholders of the Rome Wire Co., held at the company's offices, Railroad St., Rome, N. Y., a proposition to increase the capital stock of the company was unanimously adopted.

The Morris Machine Tool Co., Cincinnati, Ohio, has bought the business of the American Metal Products Co., manufacturer of screw-machine products, automobile starting cranks and drag links, Cincinnati, Ohio.

The Aetna Machinery Corporation recently organized and incorporated in New Jersey has its principal offices and warehouse at 15 Mechanic St., Newark N. J. This company has no other branches or offices and all communications should be sent to the Newark address.

The Joseph T. Ryerson & Son Co., Chicago, Ill., is distributing its new bulletin No. 5015, describing the new Ryerson-Conradson No. 3 high-power milling machine which it is now marketing. The bulletin also contains a description of the vertical milling attachment and universal dividing head for use on these machines.

Personals

G. DANNEHOWER, vice president of the C. E. Johansson, Inc., New York City, has resigned his position.

C. A. MARSH, of the Associated Manufacturing Co., Waterloo, Ia., returned recently from a six weeks' business trip to England.

A. M. PESKINE, formerly manager of Iznosskoff & Co. and more recently with Youreveta & Co., both of New York City, has joined R. S. Stokvis Zonen, Inc.

E. E. YAKE, of 21 Kenwood terrace, has resigned his position with the Gilbert & Barker Manufacturing Co., Springfield, Mass., and has accepted a position with the Walworth Manufacturing Company.

E. W. HIATT, who, for the past five years, has been factory manager and engineer of the Saginaw Sheet Metal Works, Saginaw, Mich., manufacturers of automotive sheet metal parts, has resigned his position.

ALEXANDER HARPER, of Bristol, Conn., was recently elected president of the American Silver Co. Only a comparatively short time ago, Mr. Harper was a bank clerk, which illustrates anew the possibilties awaiting young men of sincerity and ability.

B. C. SAUNDERS, formerly sales manager of the Wilmarth & Morman Co., has become identified with the Grand Rapids Grinding Machine Co., of Grand Rapids, Mich., as secretary and sales manager.

New Publications

Hendricks' commercial register of the United States for buyers and sellers. Twenty-eighth annual edition, 1919-1920. S. E. Hendricks Co., Inc., New York.

The twenty-eighth annual edition of "Hendricks' commercial register of the United States for buyers and sellers for 1920" has just been published, after being delayed for two months by the strike of the printers in New York. The new edition contains several improvements. The most noticeable being the new method of exterior indexing by coloring the front edge red, white and blue to indicate the different main sections of the book.

The first section is blue, on which is stamped the words "Trade Index." This contains 162 pages in which every product listed in the book is indexed and cross-indexed for ready reference. The red section is the main classified trades list. It contains 1,813 pages listing over 18,000 different products. In the present edition we find over 1,200 new headings, including many completely covering the chemical industry. The third section of the book, as indicated by the white edges, contains 216 pages listing the trade names under which products are manufactured, with the names and addresses of the manufacturers. The second blue section is the Alphabetical Section of 487 pages containing all the names in the book in one alphabetical list, with addresses and their line of business. This is followed by the index to advertisers of 20 pages, containing a full list of branch and foreign offices following each name. The whole book makes a volume of 2,703 pages.

The list of trade headings covers from the raw material to the finished article all products connected with the electrical, engineering, hardware, iron, mechanical, mill, mining, quarrying, chemical, railroad, steel, architectural, contracting and kindred industries, and the firms listed cover producers, manufacturers, dealers and consumers.

Rectangular Areas. By A. W. M. Elliot. Scott, Greenwood & Son, London, and D Van Nostrand Co., New York. 5 x 7½ in., 93 pages. Price $3.

This little book is intended for use by tin-plate manufacturers and others using superficial areas in their business. It consists of tables giving areas from 8¼ x 8¼ in., advancing by quarter inches to 54 x 28 in., and other useful sizes up to 40 x 40 in. Areas are given in whole square inches and decimals. A simple method of finding areas is given when one decimal is expressed in eighths or sixteenths of an inch and the other in quarters of an inch. The book should prove very useful within its limits to all whose calculations are in terms of area.

The Military Engineer (formerly "Professional Memoirs"), the Journal of the Society of American Military Engineers. Published at Washington Barracks, D. C. 112 pp., 9 x 12 in. illustrated.

We have just received the first issue of "The Military Engineer," the new title of "Professional Memoirs," the old organ of the Corps of Engineers, United States Army.

The new paper is very attractive in appearance and contains a well-balanced ration of editorials, news, professional papers and comment. It seems to us that it should fulfill admirably its mission as the mouthpiece of a new organization, the Society of American Military Engineers.

This society shows promise of supplying a long-felt want in a means of linking military and civilian engineers to their mutual advantage and we are heartily in favor of it.

We extend our congratulations and best wishes to the modest "amateur" board of editors. If they have as much success with subsequent issues as they have had with this one they sould be well satisfied with their achievements.

Forthcoming Meetings

The American Society Steel Treaters will hold a meeting at the Engineers' Club of Philadelphia, March 26, 1920.

The Association of Iron and Steel Electrical Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 3.

The American Society Heating and Ventilating Engineers will hold a meeting at the Engineers' Club of Philadelphia, April 8.

The American Welding Society will hold its annual meeting at the Engineering Societies Building, 33 West 39th St., New York City, on Apr. 22, 1920, at 10:30 a.m. Howard C. Forbes is the secretary.

The National Metal Trades Association will hold a convention at the Hotel Astor, New York City, on April 19 to 22, 1920. H. D. Sayre is the secretary.

The National Chamber of Commerce will meet in Atlantic City, N. J., on April 26, 27 and 28.

The American Supply and Machinery Manufacturers' Association, the Southern Supply and Machinery Dealers' Association and the National Supply and Machinery Dealers' Association will meet jointly on May 17, 18 and 19 at Atlantic City, N. J., at the Hotel Marlborough-Blenheim. F. D. Mitchell is the secretary and treasurer of the American Supply and Machinery Manufacturers' Association, with an office at 4106 Woolworth Building, New York City.

The National Machine Tool Builders' Association will hold its spring meeting on May 20 and 21 at the Hotel Traymore, Atlantic City, N. J.

The American Society of Mechanical Engineers will hold its spring meeting at St. Louis, Mo., May 24, 25, 26, 27, 1920, and will have its headquarters at the Hotel Statler.

The American Iron and Steel Institute will hold its spring meeting at the Hotel Commodore, New York City, May 28.

The spring meeting of the American Iron and Steel Institute will be held May 28 at the Hotel Commodore, New York.

The American Society for Testing Materials will hold its next annual meeting during the week of June 21, 1920, at the New Monterey Hotel, Asbury Park, N. J. This society has its headquarters in the Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa. C. L. Warwick is the secretary and treasurer.

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of Eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Maufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Pa.

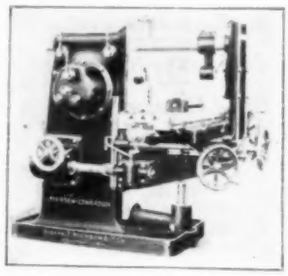
Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Pa., Howard Evans, secretary, Pier 45, North Philadelphia, Pa.

Rochester Society of Technical Draftsmen. Monthly meeting, first Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

Condensed-Clipping Index of Equipment

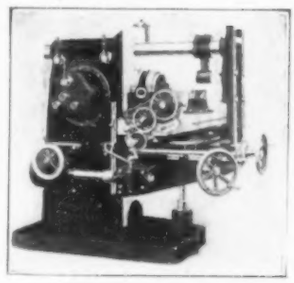
Patented Aug. 20, 1918

Milling Machine, Conradson No. 3 Plain
Jos. T. Ryerson & Son, Chicago, Ill.
"American Machinist," March 11, 1920



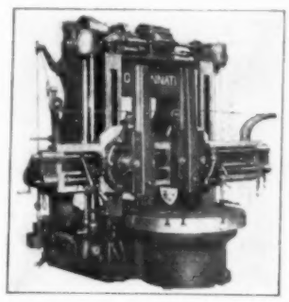
Specifications: Longitudinal movement, 35 in.; cross traverse, 14⅝ in.; vertical movement, 20 in. Front spindle bearing, 4¼ x 4⅞ in.; rear spindle bearing, 3¾ in. Taper hole in spindle, No. 11 B. & S. Distance, spindle center to bottom of arm, 6⅞ in. End of spindle to arbor bushing, 27 in. Face of spindle to arm braces, 30⅞ in. Diameter of overarm, 4⅜ in. Table, 63¼ x 12⅜ in.; working surface, 53 x 12⅜ in. Twelve spindle speeds from 17 to 290 r.p.m. Sixteen feed changes from 0.6 to 22.3 in. per minute. Floor space, 76½ x 111 in. Pulley, 14 x 4 in. Speed, 600 r.p.m. Weight, 5,575 lb.

Milling Machine, Conradson No. 3 Universal
Jos. T. Ryerson & Son, Chicago, Ill.
"American Machinist," March 11, 1920



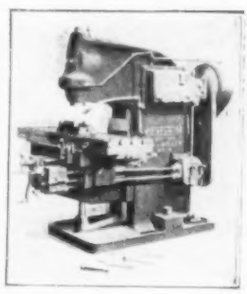
Specifications: Longitudinal movement, 34 in.; cross traverse, 13 in.; vertical movement, 18½ in. Front spindle bearing, 4¼ x 4⅞ in.; rear spindle bearing, 3¾ in. Taper hole in spindle, No. 11 B. & S. Distance, spindle center to bottom of arm, 6⅞ in. End of spindle to arbor bushing, 27 in. Face of spindle to arm braces, 30⅞ in. Diameter of overarm, 4⅜ in. Table, 63¼ x 12⅜ in.; working surface, 53 x 12⅜ in. Twelve spindle speeds from 17 to 290 r.p.m. Sixteen feed changes from 0.6 to 22.3 in. per minute. Floor space, 76½ x 111 in. Pulley, 14 x 4 in. Speed, 600 r.p.m. Weight, 5,910 lb.

Mill, Vertical Boring
Cincinnati Planer Co., Cincinnati, Ohio
"American Machinist," March 11, 1920



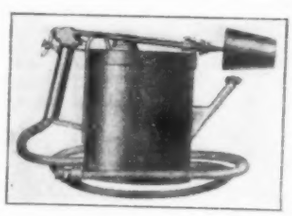
Specifications: Sizes, 42-in. and 48-in.; swings, 44 in. and 50 in.; height under toolholders, 39 in.; travel of tool bars, 27 in.; diameter of tables, 43 in. and 48 in.; diameter of spindle bearings, 8½ in.; number of feeds, 8; range of feeds, ¼ to ½ in. per minute; revolution of table, 2.45 to 59.2 and 2.1 to 50.5 per minute; size of motors, 10 hp.; speed of motors, 500 to 1,000 r.p.m.; weight of machines, 15,000 to 19,000 pounds.

Maximiller, No. 4 Vertical
Kempsmith Mfg. Co., Milwaukee, Wis.
"American Machinist," March 11, 1920



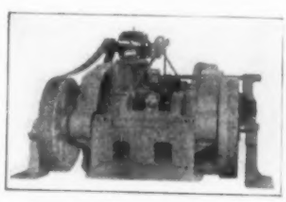
Specifications: Table working surface, 70 x 18 in.; longitudinal movement, power, 42 in.; transverse movement, power, 14 in.; vertical movement, power, 20 in.; nose of spindle to table in lowest position, 22 in.; throat distance, 19 in.; spindle taper hole, No. 12 B. & S.; eighteen spindle speeds, ranging from 14 to 355 r.p.m.; eighteen feed changes, from ⅝ to .25 in. per minute; rapid power traverse, longitudinal 100 in., transverse and vertical, 36 in. per minute; driving pulley, 16⅞ in. in diameter, 6 in. belt, 400 r.p.m.; power required for motor drive, 15 hp. at 1,200 r.p.m.; floor space, 99 x 122 in.; net weight, 11,050 lb.; weight packed for domestic shipment, 11,800 lb.; packed for foreign shipment, weight, 11,975 lb.

Torch, Jiffy
Mahr Mfg. Co., Minneapolis, Minn.
"American Machinist," March 11, 1920



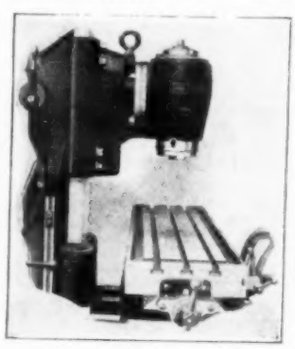
It is said to light instantly and to project a blue flame of intense heat any distance required from a few inches to five feet. It burns light fuel oil or kerosene equally well, and operates by means of compressed air supplied by a hose connection. Any available source of compressed air may be used, as the amount of the pressure is immaterial.

Forging Machine, Upsetting
Ajax Mfg. Co., Cleveland, Ohio.
"American Machinist," March 11, 1920



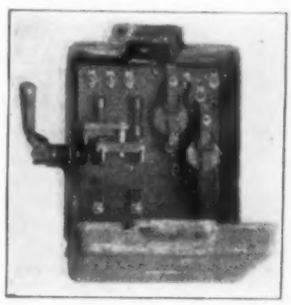
Machine is self-adjusting safety pitman as a protection against overloading and is approximately 40 per cent heavier than the older model; the 4-in. size weighs 120,000 lb.; the 5-in. size, 155,000 lb., and the other sizes are of the same proportion. A 4-in. machine, in a single blow, forged a disk 9½ in. in diameter and 1¼ in. thick on the end of a 3½-in. bar of 0.60-carbon content, at a cherry-red heat. In doing this the machine gathered 8 in. of stock and flattened it out with no tendency to stalling.

Attachment, Vertical Milling
Jos. T. Ryerson & Son, Chicago, Ill.
"American Machinist," March 11, 1920



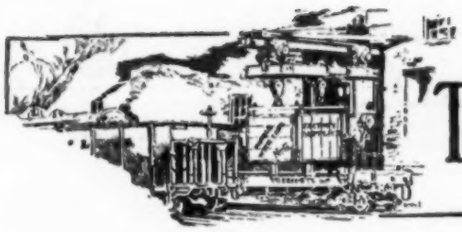
Made in three types, light (1PM3); medium (2PM3); heavy (3PM3). Speed, 600 r.p.m. Pulley speed, 34-580, 17-290, 8½-145. B. & S. taper, No. 9, 11, 11. Spindle to table; plain milling machine, 13¾, 18, 17 in.; universal machine, 12¼, 16¾, 15½ in. Center of spindle to face of column, 11¼, 11½, 14½ in. Weight, 250, 328, 450 lb.

Starter, Automatic
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
"American Machinist," March 11, 1920



The equipment consists of an automatic motor-starter panel of the counter-electromotive-force type completely inclosed in a cast-iron case with a hinged cover. A magnetic main-line contactor mounted on the panel allows remote control from two push-button switches of the momentary contact type. This starter is for use with small direct-current motors not rated over 2 hp. at 115 volts or 3 hp. at 230 volts.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Month Ago
No. 2 Southern	$44.60	$44.60
Northern Basic	42.80	42.80
Southern Ohio No. 2	43.80	43.80
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	47.65	47.65
Southern No. 2 (Silicon 2.25 to 2.75)	47.70	47.70
BIRMINGHAM		
No. 2 Foundry	41.00	41.00
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	45.35-45.65*	45.35-45.65*
Virginia No. 2	43.25*	43.25*
Basic	43.00†	43.00†
Grey Forge	42.50*	42.50*
CHICAGO		
No. 2 Foundry local	43.25	43.25
No. 2 Foundry, Southern	46.60	46.60
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	43.65	43.65
Basic	42.90	42.90
Bessemer	43.40	43.40
MONTREAL		
Silicon 2.25 to 2.75%	43.25	43.25

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.97	$3.47	$4.07	$5.50	$3.97	$3.97	$4.07
Soft steel bars	4.12	3.52	3.97	5.00	4.07	3.87	3.97
Soft steel bar shapes	4.12	3.52	3.97	...	4.07	3.87	3.97
Soft steel bands	5.32	4.22	4.57	6.25	...	...	...
Plates, ¼ to 1 in. thick	4.17	3.67	4.27	5.00	4.47	4.17	4.27

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.90
Warehouse, New York	4.57	4.17
Warehouse, Cleveland	3.42	3.82
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-4.00	6.12-6.80	5.17	7.30	6.02
No. 12	3.60-4.05	6.17-6.85	5.22	7.40	6.07
No. 14	3.65-4.10	6.22-6.90	5.27	7.45	6.12
No. 16	3.75-4.20	6.32-7.00	5.37	7.55	6.22
Black					
Nos. 18 and 20	4.15-4.80	7.30-7.30	6.02	7.95	6.80
Nos. 22 and 24	4.20-4.85	7.35-7.35	6.07	8.00	6.85
No. 26	4.25-4.90	7.40-7.90	6.12	8.05	6.90
No. 28	4.35-5.00	7.50-8.00	6.22	8.15	7.00
Galvanized					
No. 10	4.70-6.00	7.75-9.00	8.22	8.50	7.15
No. 12	4.80-6.10	7.85-9.10	8.27	8.60	7.20
No. 14	4.80-6.10	7.85-9.10	8.42	8.60	7.35
Nos. 18 and 20	5.10-6.40	8.15-9.40	8.72	8.90	7.65
Nos. 22 and 24	5.25-6.55	8.30-9.55	7.12	9.05	8.05
No. 26	5.40-6.70	8.45-9.70	7.27	9.20	8.20
No. 28	5.70-7.00	8.75-10.00	7.57	9.50	8.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. **Automobile sheets are unavailable except in fugitive instances, when prices range to 15c per lb.**

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.50	$5.40	$5.50
Flats, square and hexagons, per 100 lb. base	6.00	5.90	5.50-6.00

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00-26.00	$25.50-30.00
Cleveland	20.00	20.00
Chicago	21.00	16.50

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
3/16, 1/4, 5/16, 3/8, 7/16, 1/2, No. 8, 9/16 and No. 10	21.00 to 30.00	3/16 by 12 in. long	14.00
		1/4 by 19 in. long	12.00
5/16		3/8 by 19 in. long	10.00
No. 12		1/2 by 21 in. long	10.00
7/16, No. 14 and 1/2		Special Welding Wire, Coated	
No. 18		1/4	33.00
No. 20		5/16	30.00
Domestic 20c. for 1/4, 15c. for 1/2 to 3/4		3/8	38.00

MISCELLANEOUS STEEL—The following quotations in cents per poundare from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	9.00
Spring steel (light)	8.00	11.00	12.25
Coppered bessemer rods	8.00	8.00	7.35
Hoop steel	5.57	6.50	5.32
Cold-rolled strip steel	11.50	8.25	10.00
Floor plates	6.55	6.00	6.52

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
1/8, 1/4 and 3/8	47%	20½%	1/8 to 1¼	34½%	18½%
1/2	51%	36½%			
3/4 to 3	54%	41½%			

LAP WELD

2	47%	34½%	2	28½%	14½%
2½ to 6	50%	37½%	2½ to 6	30½%	17½%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	43%	25½%	1/8 to 1/4	34½%	19½%
1/2	48%	35½%			
3/4 to 1¼	52%	39½%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	45%	33½%	2	29½%	16½%
2½ to 4	48%	36½%	2½ to 4	31½%	19½%
4½ to 6	47%	35½%	4½ to 6	30½%	18½%

Stock discounts in cities named are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1/8 to 3 in. steel butt welded	40%	24%	40%	31%	54%	40½%
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50%	37½%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 23%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	18.50	19.25	16.00
Tin in 5-ton lots	61.50	60.00	72.50
Lead	9.00	8.75	5.25
Spelter	8.70	9.55	6.75
ST. LOUIS			
Lead	8.87½	8.375	5.00
Spelter	8.37½	9.225	6.40

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago Current	Chicago Year Ago
Copper sheets, base	29.50	29.50	22.50	31@32	24.50	36.00	32.00
Copper wire (carload lots)	29.25	29.25	23.00	29.50	23.00	27.00	28.50
Brass sheets	26.50	26.50	18.75	29.00	25.00	27.00	29.00
Brass pipe	32.00	32.00	28.00	34.00	33.00	35.00	37.00
Solder (half and half) (case lots)	39.00	39.00	46.50	40.50	41.50	38.00	39.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	23.75	18.50
New York	23.75	19.50
Cleveland	27.00	24.00
Chicago	26.00	28.50

SHOP MATERIALS AND SUPPLIES

ZINC SHEETS—The following prices in cents per pound prevail:
Carload lots f.o.b. mill..... 12.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	14.45	15.50	14.80
New York	14.00	12.00	14.50	13.00
Chicago	15.00	22.00	15.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	11.00	7.50
Chicago	12.00	8.50
Cleveland	13.00	10.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York		Cleveland		
	Current	One Year Ago	Current	One Year Ago	Chicago
Copper, heavy, and crucible	16.50–17.00	14.75	17.00	14.00	16.75
Copper, heavy, and wire	16.00–16.50	14.00	17.00	13.00	15.75
Copper, light, and bottoms	15.00–15.50	11.50	15.00	11.00	14.75
Lead, heavy	6.75–7.00	4.00	7.50	4.00	8.25
Lead, tea	6.00–6.25	3.00	5.50	3.00	7.00
Brass, heavy	11.50–12.00	8.50	13.50	8.00	16.75
Brass, light	9.00–9.50	7.00	10.00	6.00	10.50
No. 1 yellow brass turnings	9.50–10.00	9.00	10.50	6.50	10.50
Zinc	6.00–6.25	4.50	5.50	3.50	6.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	33.00	25.00
Chicago	29.00	38.00
Cleveland	32.00	28.00

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	71.00	77.00	70.00	75.00
Commercial	50.00	42.00	21.50	18.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$3.00	.80	$1.00	$1.25	$1.25	.98
Hot pressed hexagon	+ 3.00	.80	1.00	1.10	1.25	.78
Cold punched hexagon	+ 3.00	2.50	1.00	1.00	.90	1.00
Cold punched square	+ 3.00	2.50	1.00	1.00	.90	1.00

Semi-finished nuts, ⅞ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	40%	50–10%
Chicago	50%	50%
Cleveland	55%	60%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	20%	40+5%	35–5%
Larger and longer up to 1¼ in. by 30 in.	10%	30%	25–5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iron washers:
New York..... list Cleveland..... $3.75 Chicago..... $3.00
For cast-iron washers, ⅜ and larger, the base price per 100 lb. is as follows:
New York..... $5.00 Cleveland..... $4.50 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	20%	40%	30%
Larger and longer up to 1 in. by 30 in.	10%	20+10%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	List	30%	List
Chicago	10%	List	10%	List plus 20%
New York	10%	40% from list	10%	20% from list

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	30%	45%	45%
Tinned	30%	45%	45%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York...$6.00 Cleveland...$4.00 Chicago....$5.37 Pittsburgh...$4.72
Structural, same sizes:
New York...$6.10 Cleveland...$4.10 Chicago....$5.47 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	36.00	35.00
Brass	33.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb. advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb. 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $8.50 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK			
	Current	One Year Ago	Cleveland	Chicago
White	13.00	11.00–13.00	16.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50–12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x15½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.25	4.25	3.62
Chicago	5.00	5.00	4.125

COKE—The following are prices per net ton at ovens, Connellsville:

	Mar. 18	Mar. 11	Mar. 4	Feb. 26
Prompt furnace	$6.00	$6.00	$6.00	$6.00
Prompt foundry	7.00	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

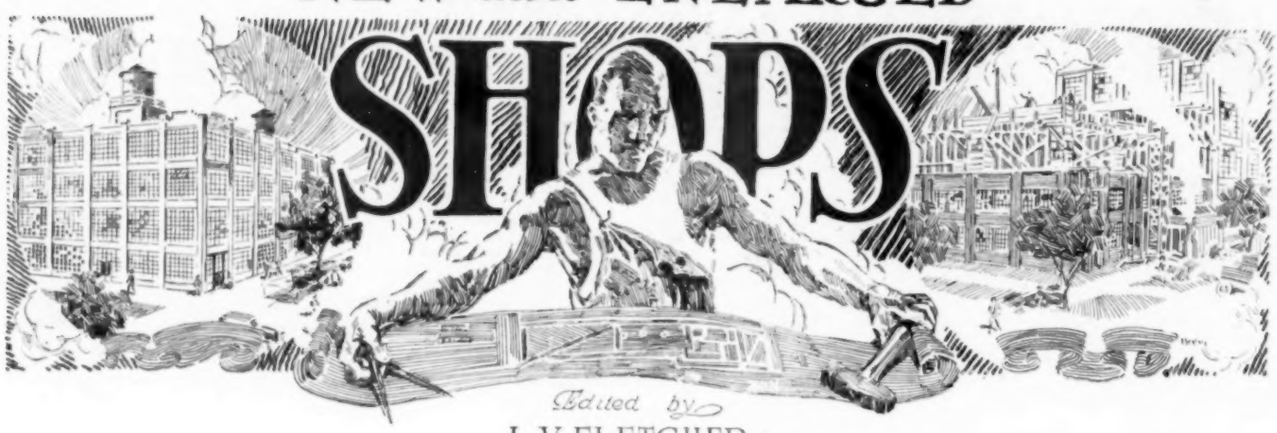
	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.80	$1.55	$2.05	$1.66
5-gal. cans	2.00	1.70	2.30	1.86

WHITE AND RED LEAD—Base price per pound:

	Red				White			
	Current		One Year Ago		Current	One Year Ago		
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil		
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00		
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25		
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50		
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00		
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00		

500 lb. lots less 10% discount. 2000 lb. lots less 10–2½% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machinery and machine tools.

Md., Baltimore—The Bartlett Hayward Co., Scott and McHenry Sts.—gate shears, 10 ft. blade for $\frac{3}{16}$ in. plate, multiple spindle drill press, 6 spindle, to drill $6\frac{1}{4}$ in. holes in $\frac{5}{8}$ in. plate. (new or used).

Md., Baltimore—The Emery Steel Castings Co., 603 Continental Bldg. and 210 North Garrison Lane, L. J. Emery, Mgr.—machine tools.

N. J., Burlington—The United States Cast Iron Pipe and Foundry Co.—lathes, shapers, drill presses and planers.

N. J., Camden—G. Janicky, 922 North Front St.—small bench lathe.

N. J., Newark—Kehler & Goldstein, 294 Summer Ave.—garage equipment.

N. J., Newark—The McGann Co., 146 Front St.—machine shop equipment.

N. Y., Buffalo—The Precision Machine and Tool Co., Wix and Lakeshore Aves.—Gridley automatic screw machine, B. & S. automatic screw machine and a Warner-Swasey turret lathe.

N. Y., Endicott—The Endicott Forging and Mfg. Co.—forging hammers, (power), and machine tools.

N. Y., Harrisville—J. Degraff—engine lathe, upright drill press, shaper and planer.

N. Y., New York (Borough of Manhattan)—The Antonio Oller Co., 180 Broadway—plain cutter and tool grinders, Cincinnati Milling Machine Company type, rapid production lathes, 16 x 4 ft., Le Blond type; 18 in. x 3 ft. engine lathe, back geared, Le Blond type.

N. Y., New York (Borough of Manhattan)—The Commercial Union of America, 23-25 Beaver St.—lathes, millers, automatic screw machines and general shop equipment.

N. Y., New York (Borough of Manhattan)—The Grasseli Chemical Co., 347 Madison Ave.—small drill press, planer, miller, small grinder. **(For Staten Island plant.)**

N. Y., New York (Borough of Manhattan)—The Howard Eng. Co., 253 Broadway—Universal miller with cam milling attachment.

N. Y., New York (Borough of Manhattan)—Kny-Scheerer Co., 410 West 27th St.—disc grinder.

N. Y., New York (Borough of Manhattan)—The Otis Elevator Co., 11th Ave. and 26th St.—
Two upright drill presses, one 24 in. and one 28 in.
Two single spindle sensitive drills.
Four 2 spindle sensitive drills.
Seven 3 ft. radial drills.
Thirteen 4 ft. radial drills.
One 5 ft. radial drill.
7 Blount No. 1 combination polisher and buffer.
Two 1 in. single bolt cutters.
Four No. 2 plain millers (Kempsmith or similar).
Three 10 x 48 in. plain grinders.
Two 42 in. boring mills (Bullard or similar).
Two Garvin No. 1 horizontal tapping machines.

N. Y., New York (Borough of Manhattan)—The South Amer. Development Co., 15 Broad St.—heavy duty quick change engine lathe, 30 in. swing, 20 ft. bed, with raising blocks to make a swing of 40 in., belt driven, a 4 in. radial drill, plain and a 4 in. radial drill, Universal.

N. Y., Potsdam—The Club Garage, G. B. Matthews, Prop—small. lathe, drill press and miller.

N. Y., Rochester—The Belcher Sales and Eng. Co., 150 Palm St.—six $1\frac{3}{4}$ in. 4 or 6 spindle automatic screw machines.

N. Y., Schenectady—The Genl. Electric Co., River Rd.—one 12 x 2 in. wet tool grinder, one No. 1 tool and cutter grinder, 20 in. upright drill presses, for Harrison, N. J., shop.

N. Y., Ticonderoga—The Ticonderoga Machine Wks.—one narrow bed planer, 17 ft. travel.

N. Y., Watertown—F. A. Green, 603 Leray St.—lathe and drill press.

Pa., Ardmore—N. J. Donohue—11-12 in. swing lathe for automobile repair work (used).

Pa., East Pittsburgh—The Westinghouse Electric and Mfg. Co.—general machine tool equipment for Springfield, Mass., shops.

Pa., Franklin—C. N. Hough Mfg. Co., Oil City Turnpike—a 2 in. model A Cleveland automatic machine, a $2\frac{1}{2}$ Gridley 4 spindle automatic machine, quick action press, 2 in. stroke, 100 to 125 lb. Beaudry power hammer, 4 spindle high speed drill press, 6 or 7 in. (new or used).

Pa., Philadelphia—R. J. Crozer & Co., North Amer. Bldg.—machine tools and bench equipment also garage machinery.

Pa., Pittsburgh—The Amer. Flexible Bolt Co., Union Bank Bldg.—$\frac{1}{2}$ in. bolt cutter for 12 thread; lathe, with 30 in. swing, 8 or 10 ft. bed, with taper attachment, cold squaring machine for squaring $\frac{7}{8}$ in. to $1\frac{1}{4}$ in. stock, multiple drilling machine, 6 spindle to $1\frac{1}{4}$ in. diameter.

Pa., Pittsburgh — The Atlantic Refining Co., Chamber of Commerce Bldg.—30 in. lathe.

Pa., Shamokin—A. H. Hershner—garage equipment.

Pa., Stroudsburg—The Universal Chain Co., 2nd St.—drill presses up to $\frac{1}{2}$ in. capacity.

Ala., Birmingham—The Stockham Pipe and Fittings Co.—
One 36 x 36 x 10 open side planer.
One 42 in. radial drill, motor drive.
One spur gear cutter, to have capacity of 24 x 3 in. and 36 x 4 in. maximum, motor drive.
One bevel gear cutter, capacity 18 x 3 in. and 30 x 3 in., motor drive.

Ga., Savannah—The Port Wentworth Lumber Co.—one hollow spindle screw cutting engine lathe, 30 to 36 in. swing, 16 ft. or more between centers.

S. D., Colton—G. Aga—20 to 26 in. x 10 to 14 ft. quick change hollow spindle lathe. (used). Corrected item.

Mich., Detroit—The Cadillac Motor Car Co., Woodward Ave.—general machine tools, and special machinery.

Mich., Detroit—The Fisher Body Co., c/o A. Wenk, Oakland and Piquette Aves.—1 light miller.

Mich., Kalamazoo—The Clarage Fan Co., Porter and Ransom Sts.—miscellaneous and machine shop equipment.

Mich., Muskegon—The Piston Ring Co., Sanford and Keating Sts.—grinders for piston rings.

O., Bellevue—The Ohio Cultivator Co.—
One 24 in. shaper.
One 18 in. lathe.
One 20 in. lathe.

O., Canton—The Kittoe Boiler and Tank Co., Camden Ave., S. W—26 x 8 in. lathe. (used).

O., Cincinnati—The Amer. Tool Wks. Co., Pearl and Eggleston Sts.—pipe threading machine, $2\frac{1}{2}$ to 6 in. capacity, power driven, with countershaft.

O., Cleveland—The Co-operative Stove Co., Central Ave. and East 40th St. 16 in shaper. (used).

O., Cleveland—The Demco Machine Tool Co., 706 Frankfort St.—small keyseating machine for internal work.

O., Cleveland—The Lincoln Electric Co., Kelly Ave. and East 38th St.—29 in x 16 ft. bed lathe. (used).

O., Cleveland—The Sterling Co., Blackstone Bldg.—14, 16 or 18 in lathe. (used).

O., Cleveland—Y. M. C. A., Prospect Ave. and East 22nd St.—16 in shaper.

O., Columbus—The Eaton Machine Wks., 37 Scioto St.—14 or 26 in. shaper, one 12 in. and one 60 in lathe.

O., Columbus—The Progressive Die and Tool Co., 600 North High St.—one No. 2 plain miller, 4 boring mills, five 18 in. lathes, 10 ft. centers, 1 surface grinder, 30 x 12 in. surface and one No. 5 Toledo Press.

O., Columbus—The Shartle Machine Co., 369 Dublin Ave.—one 18 in. shaper, one 24 in. shaper, two 16 in. lathes, one 20 in. lathe, one 24 in. lathe, five 20 to 32 in. drill presses.

O., Columbus—The Standard Machine Tool Co., 162 West Naghten St.—lathes, (used), also shapers and grinders.

O., Findlay—The Standard Machine Co.—16 to 24 in. shaper, drill press, one 18 in. and one 24 in. lathe.

O., Mt. Vernon—The Mt. Vernon Foundry and Machine Co.—complete machine shop equipment, including lathes, shapers, grinders and drill presses.

O., Newark—The Holliday Motor Co.—ten to fifteen 14 to 20 in. lathes, six to eight, 20 to 24 in. shapers and five B. & S. automatic millers, No. 1, No. 2 and No. 3.

O., Springfield—The Foos Gas Engine Co., Monroe and Linden Sts.—spur gear cutter to cut 2½ pitch steel gear of 42 in diameter. (used).

Wis., Manitowoc—Bd. Educ.—machine tools and machinery for manual training department.

Wis., Milwaukee—The Milwaukee Gear Wks., 2021 Walnut St.—gear cutting machine.

Mo., St. Louis—Steiner Mfg. Co., 4100 North 21st. St.—Knight milling machine or similar, wet tumbling barrel, 21 in. power hack saw and large gas furnace for hardening. (used).

Cal., Los Angeles—F. B. Henderson, c/o C. E. Finkenbinder, Archt., 729 Story Bldg.—garage and machine shop equipment.

Machinery

Md., Baltimore—Bartlett-Hayward Co., Scott and McHenry Sts.—one 10 ft. gate shear for $\frac{3}{8}$ in. plate, one straight line 6 spindle drill press, capacity ¾ and $\frac{7}{8}$ in., one multiple punch, capacity 10¼ in. holes in $\frac{7}{8}$ in. sheets, one vertical punch, 12 in. gap, capacity ½ in. hole in ½ in. plate (new).

Md., Baltimore—The Moreton Corp., 326 North Holliday St.—foundry and pattern shop equipment also machinery for the manufacture of metal and wood patterns.

N. Y., Buffalo—The Warner Jewelry Case Co., 646 Michigan Ave.—table saw with cross-cut and rip tilting table with iron base and top.

N. Y., Carthage—The Reversible Table Corp.—woodworking machinery.

N. Y., Malone—The Sulham Mfg. Co., c/o H. C. Wilder—heavy saw mill machine equipment.

N. Y., New York (Borough of Brooklyn)—R. Sanders, 188 Prospect Park, West—complete sawmill equipment.

N. Y., New York (Borough of Manhattan)—Andrews & George, 50 Church St.—One 6 in. pipe bender with 7 to 8 in. hot bending attachment.

N. Y., New York (Borough of Manhattan)—The Central R.R. of New Jersey, Liberty Street Terminal—1 plate bending machine to take 1 in. plates up 14 ft. with 240 volt D. C. motor and starting box complete (for Elizabeth, N. J., shop).

N. Y., New York (Borough of Manhattan)—The Hoole Tool and Supply Co., 105 Lafayette St.—5 ton or over hydraulic press, for pressing on gears.

N. Y., New York (Borough of Manhattan)—H. M. Larson, 395 Broadway—angle shears, to have capacity of 6 x ½ and 4 x ½ (new).

N. Y., New York (Borough of Manhattan)—The New York Machinery Exchange, 50 Church St.—

One 3½ or 4 in. forging machine.
One 6 ft. gate shear.
One 8 ft. gate shear.
One 10 ft. gate shear.
One punch for 1 in. plates, 96 in. throat.
One 6 or 8 in. angle shear.

N. Y., New York (Borough of Manhattan)—C. Zucker, 209 West 118th St.—special purpose machines. (Specifications on application.)

N. Y., Niagara Falls—The W. A. Rogers Co., 454 Main St.—One 55 in. Sturtevant steel plate planing mill exhauster capable of 12,300 C.F.M. at 3 in. static pressure, full housing.

N. Y., Ogdensburg—The J. Doyle Barrel Stove Mfg. Co.—woodworking machinery.

Pa., Philadelphia—M. R. Carson, 4829 North Broad St.—sheet metal working machinery.

Pa., Philadelphia—The Crosstown Realty Co., c/o Neubauer & Supowitz, Engrs. and Archts., 929 Chestnut St.—pumps and tanks.

Pa., York—G. W. Birchall & Sons, 250 South George St.—50 ton motor drive power hammer.

Ky., Ludlow—The Ludlow Mfg. Co., 59 Linden St.—No. 16 and No. 30 Bliss press, with or without horn.

Ill., Chicago—Acme Mfg. Co., 333 South Dearborn St.—one 36 in. band saw, one jointer, one double spindle shaper, one 36-40 in. cabinet planer, one 42 in. 3 drum sander, one swing saw, one jig saw and one boring machine, (new).

Ill., Chicago—Simonsen Koons, 8 North Desplaines St.—punch presses.

Mich., Boyne City—The Crozed Stave Co.—stave mill equipment.

Mich., Detroit—K. Bracher, 449 Townsend St.—equipment for the manufacture of cement blocks, tile, brick and artificial stone products, including motors, conveyors and unloading equipment.

Mich., Detroit—The Springman Paper Products Co., 75 Larned St.—paper die cutters.

Mich., Detroit—R. Teakle, 660 Grand River Ave.—machinery for the manufacture of drop hammer boards.

Mich., Jackson—The Cardo Tool and Stamping Co.—sheet metal working machinery.

Mich., Kalamazoo—The Kalamazoo Sanitary Mfg. Co.—equipment for the manufacture of pottery for sanitary plumbing ware.

O., Denison—The Pennsylvania R.R. West, Denison car shops—spring bending machines.

O., South Charleston—C. B. Bowersox—high speed Monarch saw (new or used), bending machines to take 1½ x $\frac{5}{8}$ in., 3 x ¾ in. and 3 x $\frac{7}{8}$ in. stock.

Wis., Milwaukee—The Glarotta Mfg. Co., 221 Grand Ave.—machinery for the manufacture of automobile clutches.

Wis., Milwaukee—The Milwaukee Brush Mfg. Co., 51 Erie St.—band saw and shaper.

Wis., Racine—Ajax Auto Parts Co., 15th and Clark Sts.—punch presses ranging in size from No. 3 consolidated inclinable up to No. 66½ straight side geared, (new).

Wis., Sheboygan—The Optenberg Iron Wks., South 7th St. and Clara Aves.—forges and molding machines.

Ia., Dubuque—The Adams Co.—one Fox or similar wood working trimmer.

Cal., La Habra—Bd. Educ.—manual training equipment.

Cal., Oroville—The Ehmann Olive Co.—machinery for olive pickling plant.

Ore., Klamath Falls—C. M. Reidy—woodworking machinery.

Ont., Aurora—The Baldwin Milling Co., Wellington St.—milling machinery, grinders, cleaners, separators, etc.

Ont., Brockville—Abbott Grant & Co., Ltd., Church St.—machinery for the manufacture of candy.

Ont., Brockville—Machinery and Foundries, Ltd.—foundry equipment.

Ont., Haliburton—Malloy & Brian—saws, planers and woodworking machinery.

Ont., Ottawa—MacDougal's Ltd., 529 Sussex St.—machine for bending and crimping stove pipe elbows.

Ont., Owen Sound—The Circle Bar Knitting Co., West Mitchell St.—knitting machinery.

Ont., Preston—Metal Single & Siding Co.—several presses, No. 21 B Bliss or similar (used).

Ont., Toronto—The Grinnell Co., Ltd.—foundry equipment.

Que., Montreal—Williams and Wilson, Ltd., 84 Inspector St.—plate bending rolls, to bend plate 1¼ in. thick by 16 ft. wide and plate ¾ in. thick by 12 ft. wide, (vertical rolls preferred).

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport—The Eastern Malleable Iron Co., Naugatuck, will soon award the contract for the construction of a 1 story, 80 x 180 ft. foundry, on South St. Estimated cost, $45,000.

Conn., Bridgeport—The Liberty Mfg. Co., 166 Elm St., plans to build a factory, for the manufacture of air-cooled motors for automobiles. Estimated cost, $100,000.

Conn., Meriden—M. B. Shenck & Co., Center St., has awarded the contract for the construction of a 1 story, 50 x 100 ft. addition to its factory, on Brittania St., for the manufacture of hardware specialties. Estimated cost, $25,000.

Conn., New Haven—G. Cemmino, 237 Wooster St., will build a 1 story, 55 x 115 ft. garage, on Olive St. Estimated cost, $25,000.

Conn., New London—A. Grippo, 6 Truman St., plans to build a 3 story garage, on Bank and Truman Sts. Estimated cost, $35,000. Payne & Griswold, Manwaring Bldg., Archt.

MIDDLE ATLANTIC STATES

Md., Baltimore—F. Rob, Raspeburg, has awarded the contract for the construction of a 1 story, 60 x 200 ft. garage, at 814 North Chester St., near Madison Ave., here. Estimated cost, $25,000.

N. J., Camden—The W. L. Hurley Co., 91 East Commerce St., is receiving bids for the construction of a 1 story, 40 x 81 ft. garage, on Pine St. and Broadway. Estimated cost, $10,000. T. Stephen, Masonic Temple Bldg., Archt.

MIDDLE WEST

Ill., Chicago—M. C. Clancy, 19 South La Salle St., has awarded the contract for the construction of a 2 story, 45 x 165 ft. service station at 3130 North Michigan Bldg. Estimated cost, $50,000.

Ill., Chicago—The Clydesdale Motor Truck Co., 4007 Wabash Ave., has awarded the contract for the construction of a 1 story, 120 x 175 ft. automobile sales and service station, on Calumet Ave. and 23rd St. Estimated cost, $80,000.

Mich., Detroit—The Cadillac Motor Car Co., Woodward Ave., has awarded the contract for the construction of a 4 story, 619 x 792 ft. factory, on Clark and Michigan Aves. Estimated cost, $2,780,000.

Mich., Detroit—R. Teakle, 660 Grand River Ave., manufacturer of drop hammer boards, will build a 2 story, 25 x 130 ft. factory. Estimated cost, $10,000. Mildner & Elsen, 924 Hammond Bldg., Archt.

WEST OF THE MISSISSIPPI

Mo., Joplin—The Joplin Steel and Malleable Co. has awarded the contract for the construction of a foundry. Estimated cost, $25,000.

WESTERN STATES

Cal., Los Angeles—F. B. Henderson, c/o C. E. Finkenbinder, Archt., 729 Story Bldg., will build a 2 story, 100 x 143 ft. garage, machine shop and store building, on Western Ave. Estimated cost, $60,000.

Cal., San Francisco—The Pioneer Motor Co., 307 Golden Gate Ave., has awarded the contract for the construction of a 4 story, 120 x 219 ft. automobile service station, on McAllister St. and Van Ness Ave. Estimated cost, $200,000.

CANADA

B. C., Vancouver—Almond's Ltd., 400 Pender St., will build a 1 story, 122 x 150 ft. warehouse and garage, on Keefer St. Estimated cost, $80,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Norwalk — Rosenwald-Wimpfheimer, Inc., manufacturer of hats, has awarded the contract for the construction of a 1 story factory and boiler house, on Wilton Ave. and Cross St. Estimated cost, $25,000. Noted Mar. 11.

Conn., Stamford—The Stamford Dyewood Co., Core Rd., has awarded the contract for the construction of alterations and repairs to its factory. Estimated cost, $30,000.

Conn., Thompsonville—The Bigelow Hartford Carpet Co., 58 Main St., plans to build an 80 x 200 ft. factory.

Me., Portland—A. S. Hinds, 20 West St., has awarded the contract for the construction of a 4 story laboratory, on Forest Ave., for the manufacture of cold cream. Estimated cost, $500,000.

Mass., Springfield—The Diamond Match Co., 111 Broadway, New York City, has awarded the contract for the construction of a 2 story, 311 x 468 ft. factory and three, 2 story, 55 x 75 ft., 35 x 60 ft. and 55 x 75 ft. storehouses. Estimated cost, $1,000,000.

Mass., West Dudley—The Burmus Paper Co. has awarded the contract for the construction of a 2 story, 50 x 220 ft. factory. Estimated cost, $60,000.

Mass., Westfield—The Vitrified Wheel Co., Emery St., has awarded the contract for the construction of a 2 story, 42 x 85 ft. factory. Estimated cost, $25,000.

R. I., Warren—The Mt. Hope Spinning Mills has awarded the contract for the construction of a 2 story, 110 x 200 ft. factory, on Cutler St. Estimated cost, $100,000. Noted Mar. 11.

MIDDLE ATLANTIC STATES

Md., Baltimore—H. J. Hemingway & Co., 2315 Orleans St., have awarded the contract for the construction of a 2 story, 40 x 100 ft. oyster packing plant, on Orleans and Bradford Sts. Estimated cost, $50,000.

N. J., Bayonne — The Nitrate Agencies Co. will build a 179 x 287 ft. factory, on West 1st St. Estimated cost, $50,000.

N. Y., Newton Falls—The Newton Falls Paper Co., Building and Loan Bldg., Watertown, is having plans prepared by C. E. Eaton, Archt., Sherman Bldg., Watertown, for the construction of a 1 story, 103 x 270 ft. machine shop, here. Estimated cost, between $75,000 and $85,000.

N. Y., New York (Borough of Brooklyn) —Devoe-Reynolds, 460 Small St., is having plans prepared by F. A. Pheips, Archt., Union Bldg., Newark, N. J., for the construction of a 6 story, 55 x 175 ft. factory, on Smith and Hamilton Sts., for the manufacture of paint.

N. Y., Rochester—The Yawman & Erbe Co., Campbell St., has awarded the contract for the construction of a 3 story, 121 x 253 ft. factory, for the manufacture of furniture. Noted Feb. 19.

N. Y., Tuckahoe—The Hodgman Rubber Co. has awarded the contract for the construction of a 5 story, 60 x 150 ft. addition to its factory. Estimated cost, $200,000. Noted Feb. 26.

N. Y., Watertown—The Taggarts Bros. Co., 595-597 Main St., W., manufacturer of paper bags, will build a 1 story, 67 x 200 ft. addition to its plant. Estimated cost, $40,000.

Pa., Allentown—The Allen Tire and Rubber Co., 510 Hamilton St., will soon award the contract for the construction of a 3 or 4 story factory. Estimated cost, $65,000.

Pa., Myerstown—The Myerstown Silk Mill Co. has awarded the contract for the construction of a 1 story, 192 x 210 ft. mill. Estimated cost, $125,000.

Pa., New Hope—The New Hope Paper Mills has awarded the contract for the construction of a 2 story, 60 x 144 ft. factory. Estimated cost, $25,000.

Pa., Philadelphia—The Standard Crown Co., Hope and Palmer Sts., manufacturer of bottles and stoppers, has awarded the contract for the construction of a 1 story, 62 x 200 ft. and 16 x 20 ft. factory. Estimated cost, $35,000. Noted Mar. 4.

Pa., Philadelphia—The Trenton Crockery Co., 106 North 2d St., has awarded the contract for the construction of a 5 story, 120 x 195 ft. factory. Estimated cost, $10,000.

SOUTHERN STATES

Ga., Savannah—The Diamond Match Co., 111 Broadway, New York City, has awarded the contract for the construction of a 4 story, 57 x 196 ft. factory.

MIDDLE WEST

Ill., Chicago—The Clemetsen Co., 2607 Flourney St., has awarded the contract for the construction of a 3 story, 100 x 300 ft. factory, on Homan and Division Sts., for the manufacture of desks. Estimated cost, $200,000.

Ill., Chicago—The Western Bag and Burlap Co., 2433 West 14th St., plans to build a factory on Crawford Ave. at 55th St. Estimated cost, $1,000,000.

Mich., Detroit—Dean & Sherk, 812 Woodbridge St., is having plans prepared by M. R. Burrowes, Archt., 435 Woodward Ave., for the construction of a 3 story factory, on Bellevue and Mack Aves., for the manufacture of thread. Estimated cost, $25,000.

O., Cincinnati—The Standard Silicate Co. has acquired a 20 acre site on Paddock Rd. and plans to build a factory. Estimated cost, $750,000.

O., Cleveland—The Federal Screen and Weatherstrip Co., 10522 Norman Ave., plans to build a 1 story factory. Estimated cost, $50,000.

O., Cleveland—The Interstate Tanning & Mfg. Co., The Arcade, is having plans prepared by Carter, Richards, Griffith Co., Engrs. and Archts., 721 Illuminating Bldg., for the construction of a 2 story, 80 x 96 ft. factory, on East 32d St. and St. Clair Ave. Estimated cost, $75,000.

Wis., Manitowoc — Bd. Educ. has purchased a site and plans to build a 3 story, 150 x 290 ft. high school, to include a manual training department. Estimated cost, $1,400,000.

Wis., Merton—The Bark River Canning Co. is having plans prepared by J. Menge, Jr., Archt., 138 Wright St., Milwaukee, for the construction of a 1 and 2 story, 120 x 245 ft. pea cannery. Estimated cost, $100,000.

Wis., Milwaukee—The Columbia Knitting & Mfg. Co., 236 Broadway, has awarded the contract for the construction of a 1 story, 115 x 220 ft. factory, on 33d St. Estimated cost, $100,000.

Wis., Sheboygan—The Levering Shoe Co., 222 Huron Ave., is having plans prepared by W. C. Weeks, Archt., Ontario Ave., for the construction of a 3 story, 69 x 148 ft. factory, on Alabama Ave. Estimated cost, $30,000.

Wis., Sheboygan — The Northfield Co., 18th St. and Martin Ave., has awarded the contract for the construction of a 4 story, 60 x 160 ft. factory, for the manufacture of furniture. Estimated cost, between $30,000 and $50,000.

WEST OF THE MISSISSIPPI

Ia., Boise—The Idaho Candy Co., 412 South 8th St., plans to build a 2 story, 100 x 130 ft. factory. Estimated cost, $50,000. Tourtellotte & Hummel, Overland Bldg., Archts.

Kan., Topeka — The Beatrice Creamery Co., 2d and Polk Sts., has awarded the contract for the construction of a 2 story, 85 x 150 ft. addition to its creamery. Estimated cost, $100,000. Noted Mar. 4.

Okla., Ada—A. L. Brown plans to build a brick plant. Estimated cost, $75,000.

Okla., Newkirk — The Newkirk Ice and Creamery Co. has awarded the contract for the construction of a 1 story, 50 x 160 ft. factory. Estimated cost, $75,000.

Okla., Red Fork—The Sunlight Carbon Co. has acquired an 8 acre site and plans to build a factory. Estimated cost, $100,000.

WESTERN STATES

Ariz., Safford — The Safford Flour Mill Co. plans to build a mill to have a daily capacity of 125 bbls. Estimated cost, $75,000.

Cal., Corning—The Corning Box Co. has acquired a 2½ acre site along the tracks of the Southern Pacific Ry. and plans to build a 2 story box factory. Estimated cost, $70,000.

Cal., La Habra — Bd. Educ. is having plans prepared by Jeffery & Schaefer, Archts., 1106 Kerchkoff Bldg., Los Angeles, for the construction of a school, to include a manual training department. Estimated cost, $80,000.

Cal., Oroville — The Ehmann Olive Co. will soon award the contract for the construction of an olive pickling plant.

Cal., Sacramento—The California Packing Corp., 6th and G Sts., plans to build a 2 story packing house. Estimated cost, $80,000. P. Bush, 101 California St., San Francisco, Engr. and Archt.

Cal., Santa Rosa—The California Packing Corp. plans to build a group of 1, 2 and 3 story packing houses. Estimated cost, $200,000. P. Bush, 101 California St., Engr.

Cal., Visalia—Bd. Educ. is having plans prepared by Swart & Ryland, Archts., Rowell Bldg., Fresno, for the construction of a school, to include a gymnasium, domestic science and manual training department. Estimated cost, $110,000.

Wash., Grand View—The Crystal Fruit Products Co. plans to build a 1 story, 40 x 80 ft. fruit processing factory. Estimated cost, $20,000.

CANADA

Ont., Aurora—The Baldwin Milling Co., Wellington St., plans to build a 2 and 3 story, flour mill. Estimated cost, $60,000.

Ont., Brockville—Abbott Grant & Co., Ltd., Church St., manufacturer of fancy biscuits and candy, plans to build a 3 story factory. Estimated cost, $70,000. B. Dillon, 43 King St., E., Archt.

Ont., Haliburton—Malloy & Brian plans to rebuild its 2 story sawmill which was recently destroyed by fire. Estimated cost, $40,000.

Ont., Owen Sound—The Circle Bar Knitting Co., West Mitchell St., plans to build a 7 story factory. Estimated cost, $20,000.

Ont., Toronto—The Canada Realty Co., Kent Bldg., will build a 3 story, 50 x 100 ft. paper box factory, on Berkeley St., for the Felder Paper Box Co., 136 Victoria St. Estimated cost, $60,000.

Que., Montreal—L. Poulin Co., Ltd., has awarded the contract for the construction of a 4 story, 30 x 50 ft. cold storage plant, on Claude St. Estimated cost, $22,000.

Current Opportunities—

Positions Vacant
Surplus Equipment for Sale
Equipment Wanted

Positions Wanted
Second-Hand Equipment for Sale
Business Opportunities

The SEARCHLIGHT SECTION

is the recognized opportunity center of this industry for every business want.

Some of the announcements in this issue may be of interest to you.

Turn Now to Pages 294 to 327